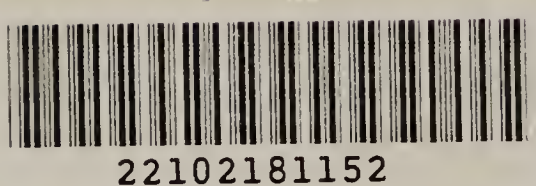
The Pharmaceutical Society
of Great Britain


22102181152

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE.

WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE."

A Journal of Practical Chemistry

IN ALL ITS APPLICATIONS TO

PHARMACY, ARTS, AND MANUFACTURES.

EDITED BY

WILLIAM CROOKES, F.R.S., &c.

VOLUME XXXVII.—1878.

LONDON:
PUBLISHED AT THE OFFICE, BOY COURT, LUDGATE HILL, E.C.
AND SOLD BY ALL BOOKSELLERS.

MDCCCLXXVIII.

LONDON:
PRINTED BY EDWIN JOHN DAVEY,
EOY COURT, LUDGATE, HILL E.C.

CANCELLED

3719

WELLCOME INSTITUTE LIBRARY
Coll. welMOmec
Call No.

OF GREAT BRITAIN

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S. (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") *Established Twenty-six Years*

Vol. 37.—No. 945. *Copyright reserved.* Friday, January 4, 1878. *Registered as a Newspaper.* PRICE, 4*d*. POST FREE, 4½*d*.

CONTENTS.

	PAGE
ARTICLES:—	
Liquefaction of Oxygen, by M. Raoul Pictet	1
Notes on the Carbolic Test for Nitric Acid, by David Lindo	3
Researches on the Physiological Function of Vine-Leaves, by Dr. H. Macagno	3
PROCEEDINGS OF SOCIETIES:—	
CHEMICAL SOCIETY.—Bromo-derivatives of Camphor—Action of Iodine on Camphor—Constitution of Terpenes and of Camphor—Hydrocarbons obtained from Pinus Sylvestris—Citric Acid as a Constituent of Imperfectly Ripe Mulberry Juice—On Cuprous Chloride	4
DEUTSCHE CHEMISCHE GESELLSCHAFT, BERLIN	6
CORRESPONDENCE.—Butter Analysis—The Institute of Chemistry of Great Britain and Ireland—Ammonia in Filtered Water—Action of Sunlight upon Solutions of Oxalic Acid	7
CHEMICAL NOTICES FROM FOREIGN SOURCES	9

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

MACTEAR'S PATENT CARBONATING FURNACE,

MANUFACTURED BY

R. DAGLISH & CO.,

ST. HELEN'S ENGINE AND BOILER WORKS,

LANCASHIRE.

Prices and other particulars on application.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TOLL END BRICK-WORKS,

TIPTON, STAFFORDSHIRE.

AGENCY.

A Technological and Analytical Chemist in the North, with a good connection, is open to accept Agencies for Specialities, Patent Processes, New Appliances and Apparatus, or of Raw and Manufactured Chemicals.—Address, first, to P. R., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.

SECOND EDITION.

Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:

ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.

Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.

Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

THE

QUARTERLY JOURNAL OF SCIENCE.

Edited by WILLIAM CROOKES, F.R.S., &c

Now ready No. LVII., *January*, 1878, price 5s.

CONTENTS.

I. Continuous Railway Breaks. By F. C. Danvers.
II. On Residual Phenomena.
III. The Action of Light upon the Colouration of the Organic World.
IV. On the Discovery of Stone Implements in Glacial Drift in North America. By Thomas Belt, F.G.S.
V. A New Theory of Trance.

Notices of Scientific Works, Scientific Notes, &c.

London: 3, Horse-Shoe Court, Ludgate Hill, E.C.

A Young Dutchman (21 years of age) desires Employment in England in a Chemical Manufactory or otherwise. Understands chemistry, natural science, and the English, French, and German languages, also book-keeping.—Address, G. de Brunne, Office of Hollandsche Spoorweg, Rotterdam.

A Young Gentleman, of Five Years' Experience in the Laboratory of a large Steel Works, seeks an Engagement as Chemist or Assistant. No objection to go abroad.—Address, G., *Iron* Office, 12, Fetter Lane, Fleet Street, London, E.C.

A Young Chemist, of German Education and four years' Practical Experience in English Analytical Laboratories and Works, will be shortly open for an Engagement.—Address for particulars and references to E. S., 36, Coupland Street, Oxford Road, Manchester.

A Graduate, B.A. of Cambridge, and B.Sc. of London, high Wrangler, and First Class in the Natural Sciences Tripos, is desirous of obtaining the post of Chemical Lecturer or Demonstrator in a good Laboratory. Has had previous experience in the work. Highest references and excellent testimonials. Present address, 4, Frithville Gardens, Shepherds' Bush, W.

To be Sold, a number of TANK WAGONS, to carry about Eight Tons each, in good condition.—For price, &c., apply to Josiah Hardman, Chemical Works, Stoke-on-Trent.

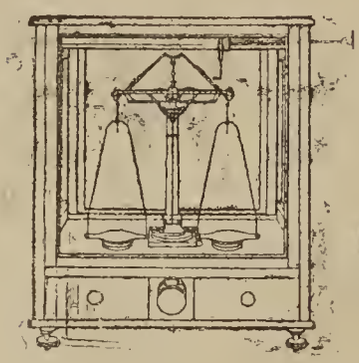
Institute of Chemistry of Great Britain and IRELAND.

Professor FRANKLAND, D.C.L., F.R.S., President.

NOTICE IS HEREBY GIVEN that the time for the Admission of Original Fellows and Associates will expire on the 2nd day of February next. For Regulations and further particulars apply, by letter, to the Secretary.

CHARLES E. GROVES, *Secretary*.

Somerset House Terrace, London, W.C



L. OERTLING,

TURNMILL STREET

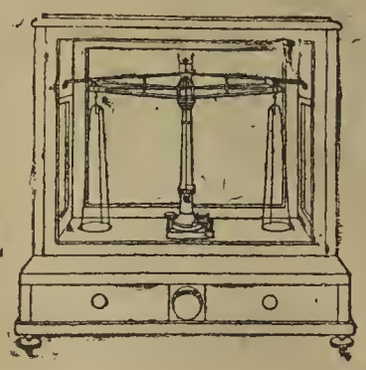
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED A.D. 1853.

FILTER PRESSES.

NEEDHAM AND KITE, Engineers, Phœnix Iron Works, Vauxhall,

The Sole and Original Inventors of the HIGH PRESSURE PATENT FILTER PRESSES,

BEG TO CAUTION the Public against Home and Foreign Imitations of their Patent Filter-Press. N. & K.'s great experience and success in filtration enables them to modify the form and material of the Press to meet every requirement, both in Metal and Wood.

Now Ready, Second Edition

OF

GRIFFIN'S CATALOGUE,

ENTIRELY REVISED.

Being the largest, most complete, and cheapest List of Apparatus ever placed before the Public.

CHEMICAL HANDICRAFT,

A Classified and Descriptive Catalogue of CHEMICAL APPARATUS, with copious Explanatory Notes.

BY JOHN J. GRIFFIN, F.C.S.

In demy 8vo. 472 pages, illustrated by 1600 woodcuts. Price 4*s*., bound in cloth. Postage, 7*d*.

PUBLISHED BY

JOHN GRIFFIN & SONS,

CHEMICAL AND PHILOSOPHICAL INSTRUMENT MAKERS,

22, GARRICK STREET, COVENT GARDEN, W.C.

BURGOYNE, BURBIDGES, CYRIAX, & FARRIES,
MANUFACTURING AND OPERATIVE CHEMISTS,
16, COLEMAN STREET, E.C.
(Prize Medal Paris Exhibition, 1867).
Manufacturers of every description of Pure Acids, Chemicals, and Reagents for Analytical Purposes and Scientific Research.
Sole Agents for C. A. KAHLBAUM, Berlin.

Price Lists and Special Quotations upon application.

Methylated Spirits.—David Smith Kidd
Licensed Maker, Commercial Street, Shoreditch, N.E
Also FINISH, FUSEL OIL and RECT. NAPHTHA.

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, Londo

MEETINGS FOR THE WEEK.

MONDAY, 7th.—Medical, 8.
—— London Institution, 5.
TUESDAY, 8th.—Photographic, 8.
—— Anthropological Institute, 8.
WEDNESDAY, 9th.—Geological, 8.
—— Society of Arts (Juvenile Lecture)
THURSDAY, 10th.—London Institution, 7.
—— Royal, 8.30.
FRIDAY, 11th.—Astronomical, 8.
—— Quekett Club, 8.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

MILTON CHEMICAL WORKS,
STOKE-ON-TRENT,
STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Special Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

MINERALS, FOSSILS, AND ROCKS.

JAMES R. GREGORY'S
NEW AND EXTENSIVE SHOW-ROOMS,
88, Charlotte Street, Fitzroy Square, London, W.

COLLECTIONS especially prepared for teaching purposes, at all prices, from half-a-guinea upwards. Also single specimens, Geological Hammers, Cabinets, Books, Glass-topped Boxes, &c.

Detailed Catalogues (74 pages) free for six stamps.

H. M. CAPNER,
Electrical and Philosophical Instrument Maker to the Trade only.
20, NORTHAMPTON SQUARE, LONDON E.C

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ar wick Chemical Works Manchester.

ROYAL POLYTECHNIC.—CHRISTMAS HOLIDAY PROGRAMME.—THE ROSE AND THE RING: A Christmas Fairy Tale, adapted from Thackeray; given by Mr. Seymour Smith, vocally assisted by Misses Lotti Verona, Marion Vere, Minnie Clifford, &c.—CHEMICAL MYSTERIES, a Holiday Lecture; and LIGHT AND COLOUR, with Interesting Experiments by Professor Gardner.—PRESTIDIGITATION Extraordinary, by Dr. Holden.—THE RUSSO-TURKISH WAR, its History and Progress to the present date; and a lecture illustrative o TORPEDO WARFARE, with an Interesting Exhibition of Torpedocs, by Mr. J. L. King.—CHRISTMAS IN THE OLDEN TIME, Merry Shadows, &c. Admission to the whole, 1s.; Reserved Stalls, 2s. 6d. Tickets can be sent by post. Annual Tickets, available till December 31st, 1878, 10s. 6d.

CHEMICAL & PHYSICAL APPARATUS,
PURE CHEMICALS, BOTTLES, &c.,
For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.
And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Galvanising Salts, Coal-Tar, Pitch Creosote, Grease, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,
ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,
BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines f any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description o Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.
Bessemer Steel Rail Plant.
Compressing Engines for Collieries, Iron Works, and Weldon' Patent Bleaching-Powder Process.
Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.
Gas Producers Patent for Heating and other Purposes.
Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.
Patent Rousing Machinery for Brewers.
Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.
Steam Superheaters improved for Oil, Tar, and Resin Refining.
Steam Sulphur Melter.
Stills for Oil, Resin, and Tar.
Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

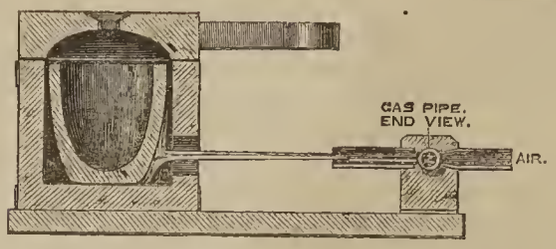
Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY
LANCASHIRE.

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.



FLETCHER'S NEW FURNACE

Will melt half-a-pound of Gold, Iron, Steel, &c., in a few minutes with a common foot-blower.

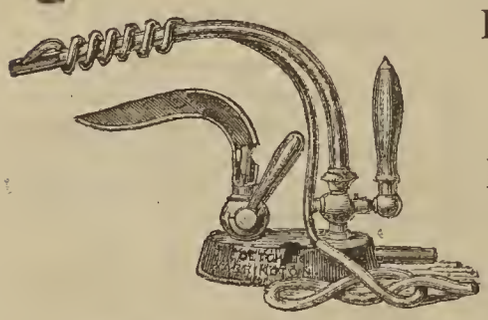
Price complete, without Blower, 8s. 6d.

A PERFECT BLOWPIPE

(FLETCHER'S PATENT, 1877).

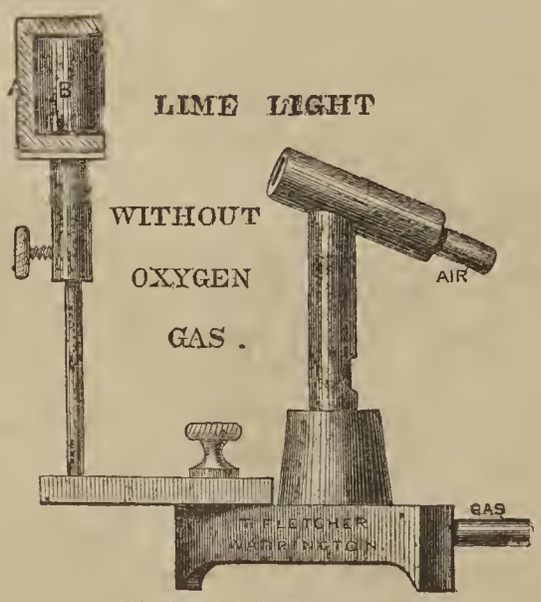
In strong Brass, ONE SHILLING.

By post, Fourteen stamps.



FLETCHER'S ORIGINAL HOT-BLAST BLOWPIPE.

Improved, 10/6.



Illustrated List on application.

THOS. FLETCHER, MUSEUM ST., WARRINGTON.

SPECIALITIES.

MANGANESE	Lump, Crystallised, Ground, and Prepared Large stock of every description. *** *Suitable for all Trades.*
ARSENIC	Refined powdered, Lump, Grey, and Ruby.
FLUOR-SPAR	Finest produced. Medium and Common for al purposes.
BARYTES	Carbonate and Sulphate. All qualities of Lump and Ground.
BAUXITE	Of high percentage of Alumina and low in Iron.

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he wil do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays..	..	£2 2 0
200 Specimens, in Cabinet, with 5 Trays..	..	5 5 0
300 Specimens, in Cabinet, with 9 Drawers	..	10 10 0
400 Specimens, in Cabinet, with 13 Drawers	..	21 0 0

More extensive Collections at 50 to 5000 Guineas each.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

DO YOUR OWN PRINTING.

The "Optimus" Printing-Press for Amateurs.

Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A HERBERT, Printing Warehouse, 50, Finsbury Square, London, E.C.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

PURE ACIDS AND CHEMICALS

FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

F. W. BERK & CO.,

18, CULLUM STREET, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE
BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

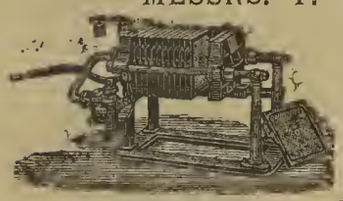
IMPROVED FILTER-PRESSES.

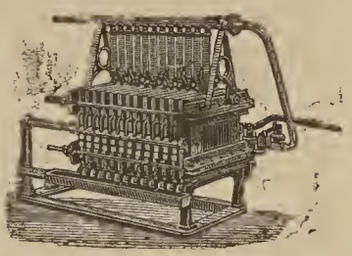
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 18, CULLUM STREET, LONDON,

Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.





WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	a.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of

CHEMICAL & SCIENTIFIC APPARATUS

Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,

89, Bishopsgate Street Within,
LONDON.

Sole Agents for Prof. Wanklyn's Test Solutions or Water Analysi

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works, Ironbridge.

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM
FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA
FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

Manufactured by the
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.
Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

TAR DISTILLERS
DRYSALTERS
BOUCK & Co
LIMITED
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp Zinc Nitric Acids &c.
BRIMSTONE REFINERS
Samples & prices on application
J.I. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID, PICRIC ACID, Sal-Aceteocelis BICHROME CHLORATE of POTASH, &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

CALVERT'S CARBOLIC ACID.

HIGHEST PRIZE MEDAL AT PARIS EXHIBITION, 1867.

GOLD AND SILVER MEDALS, HAVRE, 1868. DIPLOME D'EXCELLENCE, AMSTERDAM
SILVER MEDAL, FIRST CLASS, NAPLES, 1871. GOLD MEDAL, MOSCOW, 1872.

F. C. CALVERT & CO., of Bradford, Manchester (original and only Manufacturers of pure Medical Carbolic Acid), beg to inform the Trade and large Consumers that their pure Medical Carbolic as well as cheaper qualities for Commercial, Veterinary, and Disinfecting Purposes, also Carbolic Acid Soaps for Medical, Toilet, and General Use, Soft Soap to Dogs, and Carbolic Acid Disinfecting Powder, may be had from any of the below-named Wholesale Agents—

Apothecaries' Soc., Lond'n	Clarke, Bleasdale, & Co.	Hodgkinsons, Preston, & King	W. Mather	James Sim & Co,
Apothecaries' Co., Glasg'w	Clay, Dod, & Case	Hearon, Squire, & Francis	McMaster, Hodgson, & Co.	Sang & Barker
Apothecaries' Hall, Dublin	Dakin Brothers	Hopkin & Williams	J. F. Macfarlan & Co.	Southall, Bros., & Co.
Allen & Hanburys	Davy, Yates, & Co.	Howards & Sons	J. Mackay	W. Smeeton
J. Bell & Co.	Duncan, Flockhart, & Co.	Hirst, Brooke, & Co.	R. H. Millard & Son	Slinger & Barnett
Barron, Harveys, & Co.	W. Edwards & Son	W. R. Hatrick & Co.	Mackey, Sellers, & Co.	P. Sandeman & Co.
Barclay & Sons.	Evans, Lescher, & Evans	P. Harris & Co.	Mottershead & Co.	Tidman & Son
Burgoyne & Co.	Evans, Sons, & Co.	Hunt & Co.	Newbery & Sons	Taylor, Gibson, & Co.
Baiss Brothers & Co.	Evans, Gadd, & Co.	J. Ismay	Paterson & Son	Thacker & Hoffe
Barron, Squire, & Co.	Ferris & Co.	Johnson & Sons	Raimes & Co.	Jas. Taylor
Battley & Watts	Glasgow New Apoth. Co.	Langtons, Edden, & Hicks	J. Richardson & Co.	J. Woolley, Sons, & Co
Bewley & Draper	General Apothecaries' Co.	Lynch & Co.	Raimes, Blanshards, & Co.	Wyleys & Co.
H. B. Brady	W. & H. M. Goulding	Lofthouse & Saltmer	J. Reddish & Co.	Wilson & Kitchen
Bainbridge & Pound	Goodall, Backhouse, & Co.	Chas. Leslie	Sanger & Sons	C. H. Warner & Co.
Boileau & Boyd	Grimwade, Ridley, & Co.	Maw, Son, & Thompson	Savory & Moore.	A. & J. Warren
Curling & Co.	Hodgkinsons, Stead, & Co.	H. C. Mason	W. Sutton & Co.	Walkington & Son
Corbyn & Co.	Herrings & Co.		R. Sumner & Co.	Wright, Layman, & Umney

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,

161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

FACTORIES:
Reddish and Bradford,
MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

MANUFACTURERS OF

TOWN OFFICES:
61, Piccadilly,
MANCHESTER.

PURE CARBOLIC ACID, Cryst. at 42°·2 C. } Discovered by C. Lowe.
,, ,, do. Hydrate of } Discovered by C. Lowe.
MEDICINAL do. Cryst. at 35° C.
COMMERCIAL do. No. 1 ,, 35° C.
,, do. 2 ,, 29° C.
,, do. 3 ,, 12° C.
,, do. 4 liquid at 0° C.
CARBOLIC ACID DISINFECTING POWDER.

CARBOLIC ACID GLYCERINE SOLUTIONS.
CRESYLIC ACID.
SULPHO-PHENIC ACID (CRYST.
SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.

BENZOL (Cryst.).
ANTHRACENE.
NAPHTHALINE.
PICRIC ACID (Crystal and Paste).
AURINE (Rosolic Acid Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesal and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,

OLDBURY, NEAR BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purposes
Anthracene, Naphthaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF,

STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
& IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY
RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate Hill, E.C.
January 4, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [Established Twenty-six Years

Vol. 37.—No. 949.] Copyright reserved. Friday, January 11, 1878. Registered as a Newspaper. [PRICE, 8d. POST FREE, 8½d.

INDEX NUMBER,

CONTAINING

TITLE-PAGE, INDEX, &c., TO VOLUME XXXVI.

CONTENTS.

ARTICLES:— PAGE
Liquefaction of Nitrogen, Hydrogen, and Atmospheric Air 11
On the Sulphates of the Vanadium Tetroxide, by Dr. B. W. Gerland 11
Application of Organic Acids to the Examination of Minerals, by H. Carrington Bolton 14
PROCEEDINGS OF SOCIETIES:—
MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.—On the Construction of a Room or Series of Rooms free from Germ Life 14
PHILOSOPHICAL SOCIETY OF GLASGOW.—An Improved System of Alkali Manufacture 15
NOTICES OF BOOKS.—Elements of Agricultural Chemistry and Geology 17
CORRESPONDENCE 18
CHEMICAL NOTICES FROM FOREIGN SOURCES 20

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

MACTEAR'S PATENT CARBONATING FURNACE,

MANUFACTURED BY

R. DAGLISH & CO.,

ST. HELEN'S ENGINE AND BOILER WORKS,

LANCASHIRE.

Prices and other particulars on application.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TOLL END BRICK-WORKS,

TIPTON, STAFFORDSHIRE.

To be Sold, a number of TANK WAGONS. to carry about Eight Tons each, in good condition.—For price, &c., apply to Josiah Hardman, Chemical Works, Stoke-on-Trent.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.

SECOND EDITION.

Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:

ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.

Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.

Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

THE

QUARTERLY JOURNAL OF SCIENCE.

Edited by WILLIAM CROOKES, F.R.S., &c

Now ready No. LVII., *January*, 1878, price 5s.

CONTENTS.

I. Continuous Railway Breaks. By F. C. Danvers.
II. On Residual Phenomena.
III. The Action of Light upon the Colouration of the Organic World.
IV. On the Discovery of Stone Implements in Glacial Drift in North America. By Thomas Belt, F.G.S.
V. A New Theory of Trance.

Notices of Scientific Works, Scientific Notes, &c.

London: 3, Horse-Shoe Court, Ludgate Hill, E.C.

A Young Dutchman (21 years of age) desires Employment in England in a Chemical Manufactory or otherwise. Understands chemistry, natural science, and the English, French, and German languages, also book-keeping.—Address, G. de Brunne, Office of Hollandsche Spoorweg, Rotterdam.

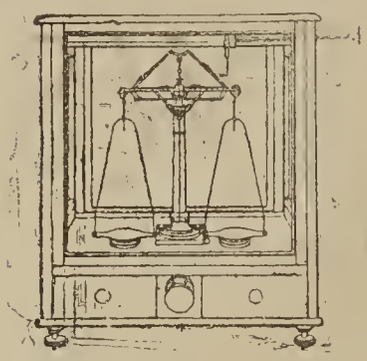
A Young Chemist, of German Education and four years' Practical Experience in English Analytical Laboratories and Works, will be shortly open for an Engagement.—Address for particulars and references to E. S., 36, Coupland Street, Oxford Road, Manchester.

A Young Man (nearly 19) who has acquired some knowledge of Analytical Chemistry seeks a Situation as Assistant to an Analytical Chemist.—Address, A. J. S., Edengate School, near Tamworth.

Wanted, a Chemist of some experience in Manure Works, as analyst, and who would be willing to assist in general office work. Apply, stating salary required, and with reference, to M. C., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Wanted, by an Experienced Analyst with kuowledge of the Manufacture of Chemicals and Drugs, engagement as Analyst or Manager of works. Good references, well educated, age 25. Apply to Azote, care of Messrs. Dawson Bros. 5, Oriental Place, Southampton.

Bar Magnets, 4 ins. by 3-8ths, 2s 6d. the pair. Ferrotype Discs, 1s. per pair. Box-wood Reels, wound with No. 36 wire, 3s. the pair. Binding-screws, 3s. the dozen. No. 36 Silk-covered Wire, 4s. the ¼ lb. Double-line Wire, 2d. per yard; best quality ditto, 3d. per yard. Flexible Silk Double-Wire Cord, 4d. and 8d. per yard. Small Electric Bells, 7s. 6d. each. Electric Call-Bell, with Key, Switch, and Battery complete, £3 the two sets; Magnetic ditto, £4 4s. Orders over 5s. post or carriage free. EDWARD PATERSON, Electric Bell Works, 3, Bedford Court, Covent Garden, W.C. Illustrated Catalogue Two Stamps.



L. OERTLING,

TURNMILL STREET

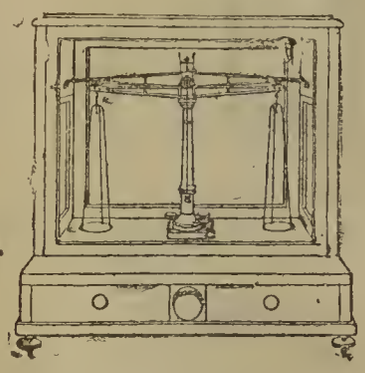
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED A.D. 1853.

FILTER PRESSES.

NEEDHAM AND KITE, Engineers, Phœnix Iron Works, Vauxhall,

The Sole and Original Inventors of the HIGH PRESSURE PATENT FILTER PRESSES,

BEG TO CAUTION the Public against Home and Foreign Imitations of their Patent Filter-Press. N. & K.'s great experience and success in filtration enables them to modify the form and material of the Press to meet every requirement, both in Metal and Wood.

ALABASTER AND CO.,

44, GLOUCESTER STREET, QUEEN SQUARE, W.C.,

MANUFACTURERS TO THE TRADE OF ALL KINDS OF

CHEMICAL AND ASSAY BALANCES.

BALANCES MADE WITH LONG OR SHORT BEAMS. STUDENTS' BALANCES AT ALL PRICES.

Illustrated Price Lists on application.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,

161, 2, 3, Palmerston Buildings, Old Broad St.,

LONDON, E.C.

BURGOYNE, BURBIDGES, CYRIAX, & FARRIES,

MANUFACTURING AND OPERATIVE CHEMISTS,

16, COLEMAN STREET, E.C.

(Prize Medal Paris Exhibition, 1867).

Manufacturers of every description of Pure Acids, Chemicals, and Reagents for Analytical Purposes and Scientific Research.

Sole Agents for C. A. KAHLBAUM, Berlin.

Price Lists and Special Quotations upon application.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA.

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street Soho, Londo

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

South London School of Pharmacy, 325, Kennington Road. Managing Director, DR. MUTER.
Daily Lectures on the following subjects:—

CHEMISTRY.	MATERIA MEDICA.
BOTANY.	PHARMACY.
PHYSICS.	CLASSICS.

The School has accommodation for 120 Students, and contains an excellent Museum and a very completely fitted Chemical Laboratory for 50 Junior and 20 Senior Pupils, with water and gas at everyworking bench.

For all particulars, enclose a stamped envelope to the Secretary, Mr. W. BAXTER, at his office, Central Public Laboratory, Kennington Cross, London, S.E.

MEETINGS FOR THE WEEK.

MONDAY, 14th.—Medical, 8.30.
—— Royal Geographical, 8.30.
—— London Institution, 5.
—— Society of Arts, 8. (Cantor Lectures). "The Manufacture of Paper," Lecture V., W. Arnot F.C.S.

TUESDAY, 15th.—Civil Engineers, 8.
—— Zoological, 8.30.
—— Society of Arts. (African Section). "Notes regarding the Zulu Kaffirs, and the Probable Influence of the Transvaal Annexation upon the Progress of Civilisation in the Interior of Africa," F. B. Fynney.

WEDNESDAY, 16th.—Meteorological 7. (Anniversary).
—— Society of Arts. "The Manufacture of India-rubber, and its Aplication to Telegraph Purposes," T. T. P. Bruce Warren.

THURSDAY, 17th.—London Institution, 7.
—— Royal, 8.30.
—— Royal Society Club, 6.30.
—— Zoological, 4.
—— Chemical, 8. "Intrinsic Luminosity of Benzole," Dr. Frankland and Mr. Thorne. "Action of Reducing Agents on Potassium Permanganate," F. Jones. "The Alkaloids of the Aconite Family.—Part II. The Alkaloids of Aconitum ferox," Dr. Wright and Mr. Luff. "Action of Sulphuric Acid on Copper," Spencer Pickering. "Decomposition Products of Quinine," Dr. Ramsay and Mr. Dobbie.

SATURDAY, 19th.—Physical, 3. "On some Physical Points connected with the Telephone," W. H. Preece, C.E, "On Grove's Gas Battery," H. F. Morley, M.A., B.Sc.

ROYAL SCHOOL OF MINES.

DR. FRANKLAND, D.C.L., F.R.S., will commence a Course of Thirty Lectures on "ORGANIC CHEMISTRY" at South Kensington, on Monday next, the 14th January, at Ten o'clock, to be continued on each succeeding Wednesday, Friday, and Monday at the same hour. Fee, £3; to those who have attended the previous Course, £2.

TRENHAM REEKS, Registrar.

OWENS COLLEGE, MANCHESTER.

The Council is prepared to appoint a DEMONSTRATOR and ASSISTANT LECTURER IN CHEMISTRY, whose time would be required to be devoted entirely to the duties of the office. The fixed stipend will be £100 per annum, Applications, accompanied by testimonials, and addressed to the Council under cover to the Registrar, will be received up to the 26th. inst. The Principal of the College will be glad to give further information respecting the duties and emoluments attached to the Office.

J. HOLME NICHOLSON, Registrar.

Institute of Chemistry of Great Britain and IRELAND.

Professor FRANKLAND, D.C.L., F.R.S., President.

NOTICE IS HEREBY GIVEN that the time for the Admission of Original Fellows and Associates will expire on the 2nd day of February next. For Regulations and further particulars apply, by letter, to the Secretary.

CHARLES E. GROVES, *Secretary.*

Somerset House Terrace, London, W.C

BERNERS COLLEGE of CHEMISTRY,

in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

MINERALS, FOSSILS, AND ROCKS.

JAMES R. GREGORY'S

NEW AND EXTENSIVE SHOW-ROOMS,

88, Charlotte Street, Fitzroy Square, London, W.

COLLECTIONS especially prepared for teaching purposes, at all prices ,from half-a-guinea upwards. Also single specimens, Geological Hammers, Cabinets, Books, Glass-topped Boxes, &c.

Detailed Catalogues (74 pages) free for six stamps.

S. A. SADLER,

CLEVELAND CHEMICAL WORKS,

MIDDLESBROUGH;

Newfall Tar Works, Carlton;

and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene ,Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Galvanising Salts, Coal-Tar, Pitch Creosote, Grease, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines f any required power, for Irrigating, Draining, Mining, Rolling Mills or Water Works purposes, and Manufacturers of every description o Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon' Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

MILTON CHEMICAL WORKS,

STOKE-ON-TRENT,

STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Special Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

PURE FATTY ACIDS.—I am anxious to obtain Specimens of any of the Pure Fatty Acids. Small quantities of One or Two Grammes would be sufficient. I shall be glad to purchase, or, if preferred, to make any other suitable acknowledgment in my power.—W. H. HATCHER, Price's Patent Candle Company (Limited), Belmont Works, Battersea, London, S.W.

DOULTON & WATTS

HIGH STREET, LAMBETH, LONDON, S.E.

DEPOTS:—GRANVILLE WHARF, WOOD STREET, BIRMINGHAM; 100, SOHO STREET LIVERPOOL; AND 18, RUE MARTEL, PARIS.

MANUFACTURERS OF

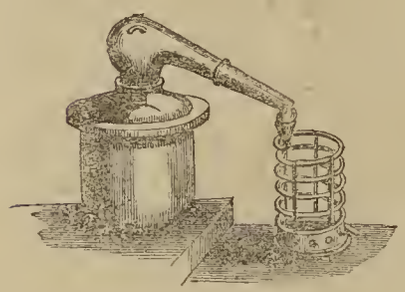
STILLS, RETORTS, CONDENSING WORMS, WOLLF'S BOTTLES

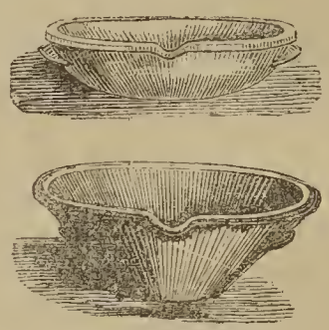
ACID PUMPS, COCKS, PERCOLATORS, AIR-TIGHT JARS,

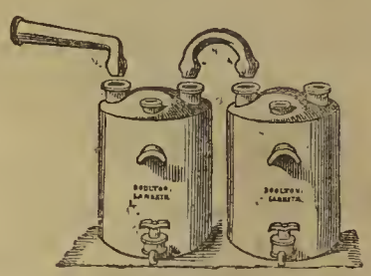
AND EVERY DESCRIPTION OF

STONEWARE FOR CHEMICAL PURPOSES,

Warranted to Resist the Strongest Acids.







PLUMBAGO CRUCIBLES, AND OTHER FIRE-STANDING GOODS.

CHEMISTS' AND DRUGGISTS' GLASS. PORCELAIN TAPS.

PRICE LISTS of any of the above, and of Every Description of Stoneware, may be had on application, and Samples seen at

Messrs. D. and W.'s SHOW ROOMS, HIGH STREET, LAMBETH.

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

MANUFACTURERS OF

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

PURE CARBOLIC ACID, Cryst. at 42°·2 C.	Discovered by C. Lowe.	CARBOLIC ACID GLYCERINE SOLUTIONS.	BENZOL (Cryst.).
,, ,, do. Hydrate of		CRESYLIC ACID.	ANTHRACENE.
MEDICINAL do. Cryst. at 35° C.		SULPHO-PHENIC ACID (CRYST.	NAPHTHALINE.
COMMERCIAL do. No. 1 ,, 35° C.		SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.	PICRIC ACID (Crystal and Paste).
,, do. 2 ,, 29° C.			AURINE (Rosolic Acid Cake and Solution.
,, do. 3 ,, 12° C.			
,, do. 4 liquid at 0° C.			
CARBOLIC ACID DISINFECTING POWDER.			

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesal nd Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,

OLDBURY, NEAR BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purposes Anthracene, Naphthaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF, STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate Hill E.C January 11, 1878.

SUPPLEMENT TO THE CHEMICAL NEWS.

CONTAINING

INDEX AND TITLE-PAGE TO VOLUME XXXVI.

BISULPHIDE OF CARBON,
PROTOSULPHATE,
RED OXIDE
OXYCHLORIDE

Sulphocyanide,
And every other Mercurial Preparation.

BISULPHITE OF LIME, TETRACHLORIDE OF CARBON
Oxysulphuret of Antimony, Glacial Acetic Acid,

LIQUOR AMMONIÆ,
SULPHIDE OF IRON,
PURE ACIDS,
CHLORIDE OF SULPHUR,
ACETONE,
CHLOROFORM,
ALDEHYDE,
CHLORATE BARYTA,
ARSENIC ACIDS,
FRUIT ESSENCES FOR CONFECTIONERY & LIQUEURS,
PERCHLORIDE OF IRON,
SULPHITE AND HYPOSULPHITE OF SODA,
PHOSPHATES OF SODA AND AMMONIA,
ETHERS,
BROMIDES,
IODIDES,
SCALE AND GRANULAR PREPARATIONS.

ALSO,
Pure Photographic Chemicals of every kind.
MANUFACTURED BY
WILLIAM BAILEY & SON,
HORSELEY FIELDS CHEMICAL WORKS,
WOLVERHAMPTON

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,
For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

JAMES WOOLLEY, SONS, & CO.

69, MARKET STREET, MANCHESTER,
DEALERS IN
CHEMICAL AND SCIENTIFIC APPARATUS
CHEMICAL REAGENTS, &c.,
FOR THE USE OF
ANALYSTS, SCIENCE TEACHERS, AND MANUFACTURERS

Price Lists on application.

THE NEW MINIATURE SPRENGEL PUMP.

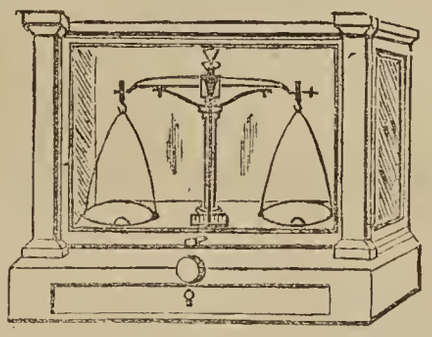
(STEARN AND SWAN'S PATENT.)

As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

BECKER & SONS,

MANUFACTURERS OF
CHEMICAL AND GOLD ASSAY BALANCES
AND OTHER
SCALES AND WEIGHTS.

ROTTERDAM.



NEW YORK.

BECKER'S STUDENT'S BALANCE, in polished mahogany glass case, sliding front, counterpoised, to carry 30 grammes in each pan and turn to ½ milligramme, nickel plated pans..£2 10
Ditto, ditto, in mahogany glass case, polished black £2 13

Sole Agents for England, Ireland, and Wales:—
TOWNSON & MERCER,

Becker's Complete Lists forwarded by post on receipt of 1*d.* stamp, or free on application.

Chemical Technology, or Chemistry in its Applications to the Arts and Manufactures. By THOMAS RICHARDSON and HENRY WATTS. Second Edition, illustrated ith numerous Wood Engravings.

Vol. I., Parts 1 and 2, price 36s., with more than 400 Illustrations.

Nature and Properties of Fuel: Secondary Products obtained from Fuel: Production of Light: Secondary Products of the Gas Manufacture.

Vol. I., Part 3, price 33s., with more than 300 Illustrations.

Sulphur and its Compounds: Acidimetry: Chlorine and its Bleaching Compounds: Soda, Potash: Alkalimetry: Grease.

Vol. I., Part 4, price 21s., 300 Illustrations.

Aluminium and Sodium: Stannates, Tungstates, Chromates, and Silicates of Potash and Soda: Phosphorus, Borax: Nitre: Gun-Powder: Gun Cotton.

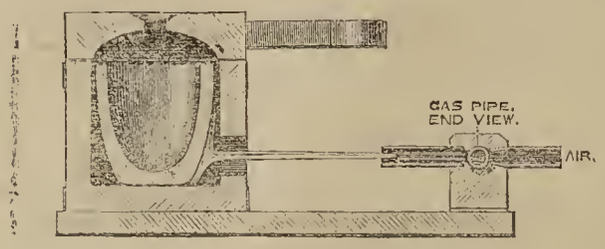
Vol. I., Part 5, price 36s.

Prussiate of Potash: Oxalic, Tartaric, and Citric Acids, and Appendices containing the latest information, and pecifications relating to the materials described in Parts 3 and 4.

BAILLIERE AND CO., 20, King William Street, Strand.

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ar wick Chemical Works Manchester.

ROYAL POLYTECHNIC.—CHRISTMAS HOLIDAY PROGRAMME.—THE ROSE AND THE RING: A Christmas Fairy Tale, adapted from Thackeray; given by Mr. Seymour Smith, vocally assisted by Misses Lotti Verona, Marion Vere, Minnie Clifford, &c.—CHEMICAL MYSTERIES, a Holiday Lecture; and LIGHT AND COLOUR, with Interesting Experiments by Professor Gardner.—PRESTIDIGITATION Extraordinary, by Dr. Holden.—THE RUSSO-TURKISH WAR, its History and Progress to the present date; and a lecture illustrative o TORPEDO WARFARE, with an Interesting Exhibition of Torpedoes, by Mr. J. L. King.—CHRISTMAS IN THE OLDEN TIME, Merry Shadows, &c. Admission to the whole, 1s.; Reserved Stalls, 2s. 6d. Tickets can be sent by post. Annual Tickets, available till December 31st, 1878, 10s. 6d.



FLETCHER'S NEW FURNAC

Will melt half-a-pound of Gold, Iron, Steel, &c., in a few minutes with a common foot-blower.

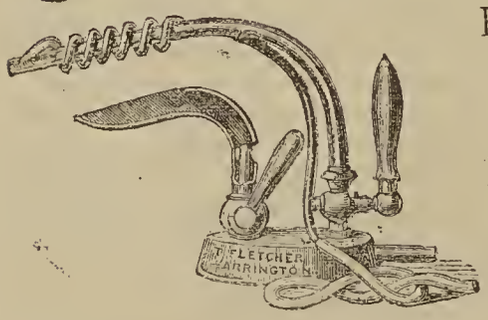
Price complete, without Blower, 8s. 6d.

A PERFECT BLOWPIPE

(FLETCHER'S PATENT, 1877).

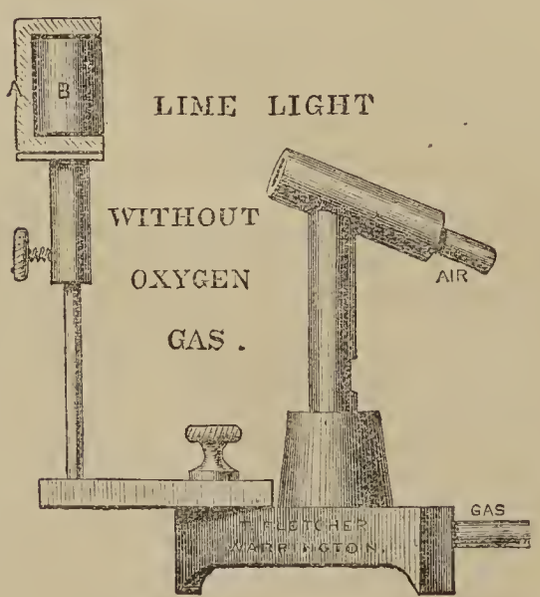
In strong Brass, ONE SHILLING.

By post, Fourteen stamps.



FLETCHER'S ORIGINAL HOT-BLAST BLOWPIPE.

Improved, 10/6.



LIME LIGHT WITHOUT OXYGEN GAS.

Illustrated List on application.

THOS. FLETCHER, MUSEUM ST., WARRINGTON.

SPECIALITIES.

MANGANESE	Lump, Crystallised, Ground, and Prepared Large stock of every description. *** *Suitable for all Trades.*
ARSENIC	Refined powdered, Lump, Grey, and Ruby.
FLUOR-SPAR	Finest produced. Medium and Common for al purposes.
BARYTES	Carbonate and Sulphate. All qualities of Lump and Ground.
BAUXITE	Of high percentage of Alumina and low in Iron:

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,

5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime and of the *highest test.*

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays..	..	£2 2 0
200 Specimens, in Cabinet, with 5 Trays..	..	5 5 0
300 Specimens, in Cabinet, with 9 Drawers	..	10 10 0
400 Specimens, in Cabinet, with 13 Drawers	..	21 0 0

More extensive Collections at 50 to 5000 Guineas each.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

DO YOUR OWN PRINTING.

The "Optimus" Printing-Press for Amateurs. Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A. HERBERT, Printing Warehouse, 50, Finsbury Square, London, E.C.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed several leading Analysts already supplied.

F. W. BERK & CO.,

18, CULLUM STREET, LONDON, E.C.

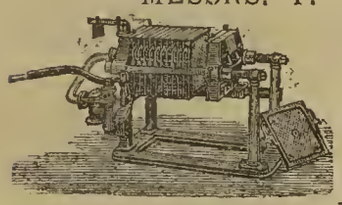
IMPORTERS AND EXPORTERS OF

POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE
BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

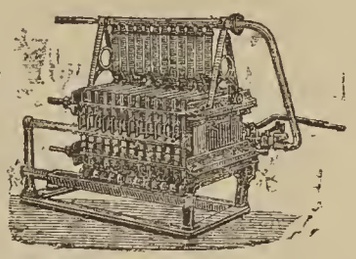
IMPROVED FILTER-PRESSES.

Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—
MESSRS. F. W. BERK & CO., 18, CULLUM STREET, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

TOWNSON & MERCER
(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Sole Agents for Prof. Wanklyn's Test Solutions or Water Analysi

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works, Ironbrid

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM
FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA
FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

Manufactured by the
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.
Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

Chemical Apparatus & Scientific Instruments.

PORCELAIN, GLASS, STONE, WOOD, AND METAL APPARATUS

FOR

CHEMICAL AND PHILOSOPHICAL PURPOSES AND LECTURES.

ELECTRICAL, MEDICAL, AND EXPERIMENTAL COILS AND APPARATUS.

BUNSEN'S MODIFIED FILTER PUMPS, from 10s. 8d. to 67s.

ELECTRICAL BATTERIES AND ELEMENTS.

Sets of Apparatus according to Professor Valentin's "Book of Chemistry," and Professor Attfield' "Manual of Chemistry."

Also Sets of Apparatus as required by the Government Schools always ready and kept in stock.

Catalogues and Illustrations will be sent Gratuitously. A Liberal Discount allowed to Wholesale Buyers.

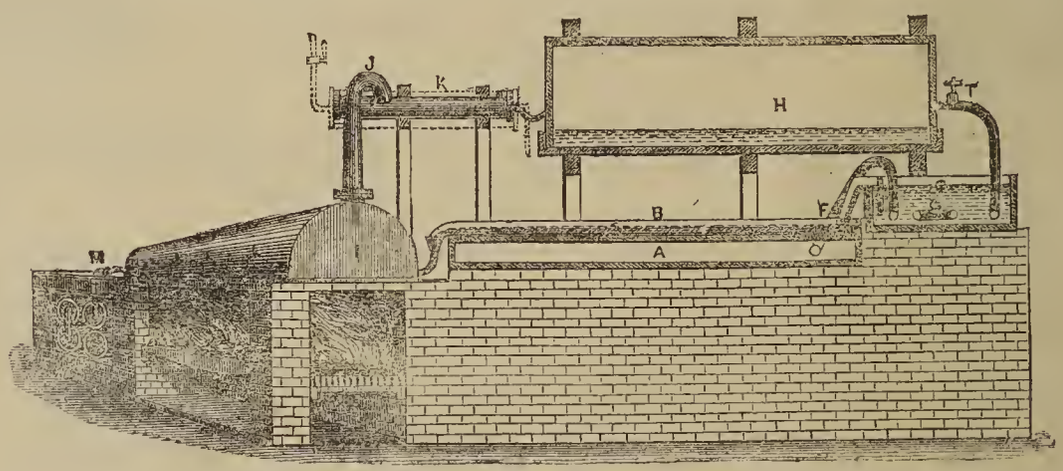
WHOLESALE IMPORTERS AND MANUFACTURERS:

AUG. BEL & CO.,

34, Maiden Lane, Strand, London, W.C.

SOLE AGENTS FOR GRENET'S BATTERIES AND NODOT'S MICROSCOPES.

NEW AND IMPROVED PROCESS AND APPARATUS FOR CONCENTRATING SULPHURIC ACID.



A, Steam Jacket, whereon is placed the Shallow Leaden Pan, B, heated by superheated steam.
C, Leaden Pan, with steam coil pipe, G, for heating the acid from the chambers.
K, Elevated Condenser. The condensed acid vapours flow direct into the chambers; may be adapted to any kind of Still in connection with the upright beak, J.
S, Pipes for superheating steam by the waste heat from the Still fire.
T, Pipe for conducting waste steam to the chamber, H.
L, Platinum Still of novel construction.

Requires less than one-half the Fuel ordinarily consumed, and costs under one-third that of the Still in common use of the same capacity. May be used either with or without the superheated steam apparatus. Old Stills will be taken in exchange and the difference in weight paid for in cash, and new ones of this description furnished by the celebrated Manufacturers, Messrs. Johnson, Matthey, & Co., Hatton Garden, London, and MM. Desmoutis, Quennessen, & Le Brun, 56, Rue Montmartre, Paris.

For Circulars containing full explanation and Terms address the Inventor and Patentee—

F. W. KALBFLEISCH, 449, Strand, Charing Cross, London.

ERECTION OF PLANT.

TO SULPHATE OF AMMONIA MANUFACTURERS AND OTHERS.

STILLS, SATURATORS, and all APPARATUS in connection with the above Erected upon the most Approved Plan—result of 15 years practical experience.—Address, G. Tunbridge, Man. Chem. Dept., Gas Works, Leicester, or J. Barnes, Plumber, &c., Barking, Essex.

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

H. M. CAPNER,

Electrical and Philosophical Instrument Maker to the Trade only.

20, NORTHAMPTON SQUARE, LONDON E.C

SOCIETY OF GREAT BRITAIN

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [*Established Twenty-six Years.*

Vol. 37.—No. 947.] *Copyright reserved.* Friday, January 18, 1878. *Registered as a Newspaper.* [PRICE, 4*d*. POST FREE, 4½*d*

CONTENTS.

ARTICLES:— PAGE
Liquefaction and Solidification of Hydrogen 23
Metallurgical Notes, by Sergius Kern, M.E. 23
Movable Jet for Wash-Bottle, by C. J. Woodward 23
Application of Organic Acids to the Examination of Minerals, by H. Carrington Bolton 24
PROCEEDINGS OF SOCIETIES:—
MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.—Note on Metallic Niobium and a New Niobium Chloride—On the Retention of Saline Impurities by Hydrated Ferric Oxide..... 25
ROYAL SOCIETY OF NEW SOUTH WALES..... 28
AKADEMIE DER WISSENSCHAFTEN, VIENNA 28
CORRESPONDENCE.—Institute of Chemistry—Butter Analysis—Ammonia in Filtered Water..... 29
CHEMICAL NOTICES FROM FOREIGN SOURCES..... 29

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

MACTEAR'S PATENT CARBONATING FURNACE,

MANUFACTURED BY

R. DAGLISH & CO.,

ST. HELEN'S ENGINE AND BOILER WORKS,

LANCASHIRE.

Prices and other particulars on application.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TOLL END BRICK-WORKS,

TIPTON, STAFFORDSHIRE.

Wanted a Chemist used to Analysis of Copper, Sulphur, and Silver, by Wet Assay; must be quick and accurate.—Apply, stating salary required, to H., care of Henry Scholefield, Esq., St. Nicholas Buildings, Newcastle-on-Tyne.

Wanted, a Chemist of some experience in Manure Works, as analyst, and who would be willing to assist in general office work. Apply, stating salary required, and with reference, to M. C., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.

SECOND EDITION.

Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:

ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.

Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.

Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

THE

QUARTERLY JOURNAL OF SCIENCE.

Edited by WILLIAM CROOKES, F.R.S., &c

Now ready No. LVII., *January*, 1878, price 5s.

CONTENTS.

I. Continuous Railway Breaks. By F. C. Danvers.
II. On Residual Phenomena.
III. The Action of Light upon the Colouration of the Organic World.
IV. On the Discovery of Stone Implements in Glacial Drift in North America. By Thomas Belt, F.G.S.
V. A New Theory of Trance.

Notices of Scientific Works, Scientific Notes, &c.

London: 3, Horse-Shoe Court, Ludgate Hill, E.C.

AGENCY.

A Technological and Analytical Chemist in the North, with a good connection, is open to accept Agencies for Specialities, Patent Processes, New Appliances and Apparatus, or of Raw and Manufactured Chemicals.—Address, first, to P. R., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

A Practical Chemist, with a good General Knowledge of Arts and Manufactures, speaks French, is a fair Designer and Draughtsman, desires an Appointment. Salary £150 per annum.—Apply by letter to F. G., 54, Metropolitan Buildings; 63, Queen Victoria Street, London, E.C.

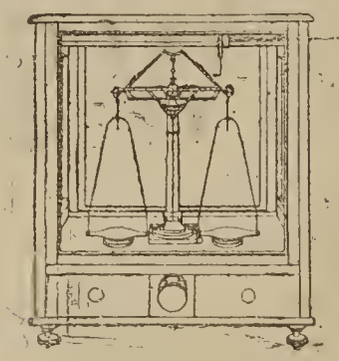
Wanted a Good Man for Saltpetre, also for Borax Refining.—Address *Z.* Y., at Horncastle's, 61, Cheapside, London, E.C.

Wanted a Chemist who fully understands the manufacture of Sulphuric and Phosphoric Acids.—Apply, stating age, experience, and salary expected, to W. and H. M. Goulding (Lim.), 25, Eden Quay, Dublin.

Bar Magnets, 4 ins. by 3-8ths, 2s 6d. the pair. Ferrotype Discs, 1s. per pair. Box-wood Reels, wound with No. 36 wire, 3s. the pair. Binding-screws, 3s. the dozen. No. 36 Silk-covered Wire, 4s. the ¼ lb. Double-line Wire, 2d. per yard. best quality ditto, 3d. per yard. Flexible Silk Double-Wire Cord, 4d. and 8d. per yard. Small Electric Bells, 7s. 6d. each. Electric Call-Bell, with Key, Switch, and Battery complete, £3 the two sets; Magnetic ditto, £4 4s. Orders over 5s. post or carriage free; EDWARD PATERSON, Electric Bell Works, 3, Bedford Court, Covent Garden, W.C. Illustrated Catalogue Two Stamps.

THE TELEPHONE.

Arrangements for Exhibiting Prof. BELL'S ARTICULATING TELEPHONE can be made by applying to EDWARD PATERSON, Agent and Licencee, 3, Bedford Court, Covent Garden, W.C.



L. OERTLING,

TURNMILL STREET

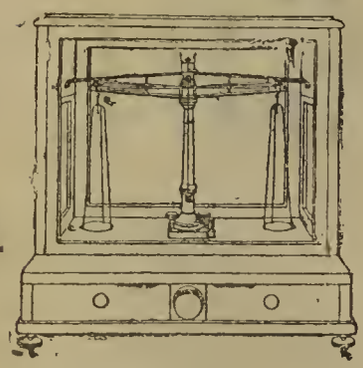
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED A.D. 1853.

FILTER PRESSES.

NEEDHAM AND KITE, Engineers, Phœnix Iron Works, Vauxhall,

The Sole and Original Inventors of the HIGH PRESSURE PATENT FILTER PRESSES,

BEG TO CAUTION the Public against Home and Foreign Imitations of their Patent Filter-Press. N. & K.'s great experience and success in filtration enables them to modify the form and material of the Press to meet every requirement, both in Metal and Wood.

Now Ready, Second Edition

OF

GRIFFIN'S CATALOGUE,

ENTIRELY REVISED.

Being the largest, most complete, and cheapest List of Apparatus ever placed before the Public.

CHEMICAL HANDICRAFT,

A Classified and Descriptive Catalogue of CHEMICAL APPARATUS, with copious Explanatory Notes

BY JOHN J. GRIFFIN, F.C.S.

In demy 8vo. 472 pages, illustrated by 1600 woodcuts. Price 4*s*., bound in cloth. Postage, 7*d*.

PUBLISHED BY

JOHN GRIFFIN & SONS,

CHEMICAL AND PHILOSOPHICAL INSTRUMENT MAKERS,

22, GARRICK STREET COVENT GARDEN, W.C.

BURGOYNE, BURBIDGES, CYRIAX, & FARRIES,

MANUFACTURING AND OPERATIVE CHEMISTS,

16, COLEMAN STREET, E.C.

(Prize Medal Paris Exhibition, 1867).

Manufacturers of every description of Pure Acids, Chemicals, and Reagents for Analytical Purposes and Scientific Research.

Sole Agents for C. A. KAHLBAUM, Berlin.

Price Lists and Special Quotations upon application.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E

Also FINISH, FUSEL OIL and RECT. NAPHTHA.

A. BOAKE & CO.,

STRATFORD, LONDON, E.,

MAKERS OF

THE SULPHITES AND BISULPHITES

OF

SODA AND LIME.

OWENS COLLEGE, MANCHESTER.

The Council is prepared to appoint a DEMONSTRATOR and ASSISTANT LECTURER IN CHEMISTRY, whose time would be required to be devoted entirely to the duties of the office. The fixed stipend will be £100 per annum, Applications, accompanied by testimonials, and addressed to the Council under cover to the Registrar, will be received up to the 26tl. inst. The Principal of the College will be glad to give further information respecting the duties and emoluments attached to the Office.

J. HOLME NICHOLSON, Registrar.

BERNERS COLLEGE of CHEMISTRY,

in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

MINERALS, FOSSILS, AND ROCKS.

JAMES R. GREGORY'S

NEW AND EXTENSIVE SHOW-ROOMS,

88, Charlotte Street, Fitzroy Square, London, W.

COLLECTIONS especially prepared for teaching purposes, at all prices from half-a-guinea upwards. Also single specimens, Geological Hammers, Cabinets, Books, Glass-topped Boxes, &c.

Detailed Catalogues (74 pages) free for six stamps.

H. M. CAPNER,

Electrical and Philosophical Instrument Maker to the Trade only.

20, NORTHAMPTON SQUARE, LONDON E.C

GEOLOGY.—In the Preface to the Student's

ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays.. ..	£2	2	0
200 Specimens, in Cabinet, with 5 Trays.. ..	5	5	0
300 Specimens, in Cabinet, with 9 Drawers ..	10	10	0
400 Specimens, in Cabinet, with 13 Drawers ..	21	0	0

More extensive Collections at 50 to 5000 Guineas each.

Ryall's Chemical Black Lead (Registered)

creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street Soho, Londo

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established

50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

PATENTS.—Mr. Vaughan, F.C.S., British

Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

DO YOUR OWN PRINTING.

The "Optimus" Printing-Press for Amateurs.

Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A. HERBERT, Printing Warehouse, 50, Finsbury Square, London, E.C.

WATER ANALYSIS.—Prof. WANKLYN,

Lecturer on Chemistry and Physics at St. George's Hospital, Public Analyst for Buckinghamshire, Buckingham, High Wycombe, Peterborough, and Shrewsbury, has REMOVED to 7 Westminster Chambers, Victoria Street, S.W.

S. A. SADLER,

CLEVELAND CHEMICAL WORKS,

MIDDLESBROUGH;

Newfall Tar Works, Carlton;

and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Galvanising Salts, Coal-Tar, Pitch Creosote, Grease, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines, of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY

LANCASHIRE.

MILTON CHEMICAL WORKS,

STOKE-ON-TRENT,

STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to

supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Special Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

Silicates of Soda and Potash in the state of

Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

PURE FATTY ACIDS.—I am anxious to

obtain Specimens of any of the Pure Fatty Acids. Small quantities of One or Two Grammes would be sufficient. I shall be glad to purchase, or, if preferred, to make any other suitable acknowledgment in my power.—W. H. HATCHER, Price's Patent Candle Company (Limited), Belmont Works, Battersea, London, S.W.

CALVERT'S CARBOLIC ACID.

HIGHEST PRIZE MEDAL AT PARIS EXHIBITION, 1867.

GOLD AND SILVER MEDALS, HAVRE, 1868. DIPLOME D'EXCELLENCE, AMSTERDAM SILVER MEDAL, FIRST CLASS, NAPLES, 1871. GOLD MEDAL, MOSCOW, 1872.

F. C. CALVERT & CO., of Bradford, Manchester (original and only Manufacturers of pure Medical Carbolic Acid), beg to inform the Trade and large Consumers that their pure Medical Carbolic as well as cheaper qualities for Commercial, Veterinary, and Disinfecting Purposes, also Carbolic Acid Soaps for Medical, Toilet, and General Use, Soft Soap o Dogs, and Carbolic Acid Disinfecting Powder, may be had from any of the below-named Wholesale Agents—

Apothecaries' Soc., Lond'n
Apothecaries' Co , Glasg'w
Apothecaries' Hall, Dublin
Allen & Hanburys
J. Bell & Co.
Barron, Harveys, & Co.
Barclay & Sons.
Burgoyne & Co.
Baiss Brothers & Co.
Barron, Squire, & Co.
Battley & Watts
Bewley & Draper
H. B. Brady
Bainbridge & Pound
Boileau & Boyd
Curling & Co.
Corbyn & Co.
Clarke, Bleasdale, & Co.
Clay, Dod, & Case
Dakin Brothers
Davy, Yates, & Co.
Duncan, Flockhart, & Co.
W. Edwards & Son
Evans, Lescher, & Evans
Evans, Sons, & Co.
Evans, Gadd, & Co.
Ferris & Co.
Glasgow New Apoth. Co.
General Apothecaries' Co.
W. & H. M. Goulding
Goodall, Backhouse, & Co.
Grimwade, Ridley, & Co.
Hodgkinsons, Stead, & Co.
Herrings & Co.
Hodgkinsons, Preston, & King
Hearon, Squire, & Francis
Hopkin & Williams
Howards & Sons
Hirst, Brooke, & Co.
W. R. Hatrick & Co.
P. Harris & Co.
Hunt & Co.
J. Ismay
Johnson & Sons
Langtons, Edden, & Hicks
Lynch & Co.
Lofthouse & Saltmer
Chas. Leslie
Maw, Son, & Thompson
H. C. Mason
W. Mather
McMaster, Hodgson, & Co.
J. F. Macfarlan & Co.
J. Mackay
R. H. Millard & Son
Mackey, Sellers, & Co.
Mottershead & Co.
Newbery & Sons
Paterson & Son
Raimes & Co.
J. Richardson & Co.
Raimes, Blanshards, & Co.
J. Reddish & Co.
Sanger & Sons
Savory & Moore.
W. Sutton & Co.
R. Sumner & Co.
James Sim & Co,
Sang & Barker
Southall, Bros., & Co.
W. Smeeton
Slinger & Barnett
P. Sandeman & Co.
Tidman & Son
Taylor, Gibson, & Co.
Thacker & Hoffe
Jas. Taylor
J. Woolley, Sons, & Co
Wyleys & Co.
Wilson & Kitchen
C. H. Warner & Co.
A. & J. Warren
Walkington & Son
Wright, Layman, & Umney

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ar wick Chemical Works Manchester.

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE Lump, Crystallised, Ground, and Prepared Large stock of every description. *** *Suitable for all Trades.*

ARSENIC Refined powdered, Lump, Grey, and Ruby.

FLUOR-SPAR Finest produced. Medium and Common for al purposes.

BARYTES Carbonate and Sulphate. All qualities of Lump and Ground.

BAUXITE Of high percentage of Alumina and low in Iron:

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,
MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime and of the *highest test.*

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

THE NEW MINIATURE SPRENGEL PUMP.
(STEARN AND SWAN'S PATENT.)

As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

F. W. BERK & CO.,

18, CULLUM STREET, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

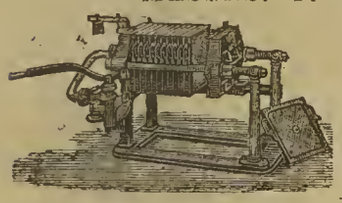
POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

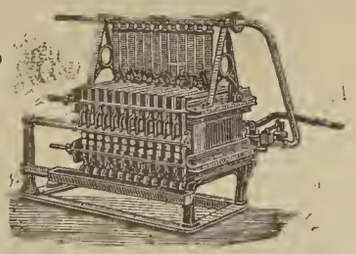
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 18, CULLUM STREET, LONDON,



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

TOWNSON & MERCER
(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Sole Agents for Prof. Wanklyn's Test Solutions or Water Analysi

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works, Ironbrid

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

Manufactured by the
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.
Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

TAR DISTILLERS — DRYSALTERS

BOUCK & Co. LIMITED
MILES PLATTING, MANCHESTER

MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia, PITCH & CREOSOTE, SULPHATE OF COPPER, VITRIOL, Nitrate Lead, Sulp Zinc, Nitric Acids &c &c.

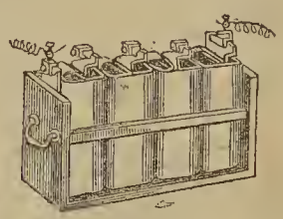
BRIMSTONE REFINERS
Samples & prices on application.
J. I. VAUGHAN Secretary

AGENTS FOR Best Scotch & English, RED & YELLOW PRUSSIATE, OXALIC ACID, PICRIC ACID, Sal-Acetosella, BICHROME, CHLORATE OF POTASH, &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR.

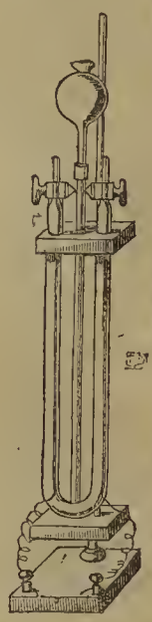
CHEMICAL & SCIENTIFIC APPARATUS,

WHOLESALE AND RETAIL.

EVERY DESCRIPTION OF APPARATUS FOR STUDY, LECTURES, OR RESEARCH.



Country Orders, accompanied by a remittance, executed same day as received; and carriage paid in England and Wales if over £2 in value.



PRICE LISTS POST FREE ON APPLICATION.

M. JACKSON AND CO.,

65, BARBICAN, LONDON.

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

MANUFACTURERS OF

PURE CARBOLIC ACID, Cryst. at 42°·2 C. } Discovered by C. Lowe.
,, ,, do. Hydrate of
MEDICINAL do. Cryst. at 35° C.
COMMERCIAL do. No. 1 ,, 35° C.
,, do. 2 ,, 29° C.
,, do. 3 ,, 12° C.
,, do. 4 liquid at 0° C.
CARBOLIC ACID DISINFECTING POWDER.

CARBOLIC ACID GLYCERINE SOLUTIONS.
CRESYLIC ACID.
SULPHO-PHENIC ACID (CRYST.
SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.

BENZOL (Cryst.).
ANTHRACENE.
NAPHTHALINE.
PICRIC ACID (Crystal and Paste).
AURINE (Rosolic Acid Cake and Solution.

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesal and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,

OLDBURY, NEAR BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purposes Anthracene, Naphthaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF,

STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
No. 5 IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY
RUNCORN

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate Hill E.C January 18, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S. (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") *Established Twenty-six Years.*

Vol. 37.—No. 948.] *Copyright reserved.* Friday, January 25, 1878. *Registered as a Newspaper.* [PRICE, 4d. POST FREE, 4½d

CONTENTS.

ARTICLES:— PAGE
On Dyer's Chemicals, by J. Marzell 33
On the Presence of Hydrogen Peroxide in the Atmosphere, by Sergius Kern, M.E. 35
Test for Elaterin, by David Lindo 35
PROCEEDINGS OF SOCIETIES:—
CHEMICAL SOCIETY.—Luminosity of Benzol when Burnt with Non-luminous Combustible Gases—Action of Reducing Agents on Potassium Permanganate—Action of Sulphuric Acid on Copper—Analysis of Sugar—Decomposition-products of Quinine 36
PHYSICAL SOCIETY.—On Some Physical Points Connected with the Telephone 37
CORRESPONDENCE.—Ammonia in Filtered Water—Institute of Chemistry 38
CHEMICAL NOTICES FROM FOREIGN SOURCES 40

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

MACTEAR'S PATENT CARBONATING FURNACE,

MANUFACTURED BY

R. DAGLISH & CO.,

ST. HELEN'S ENGINE AND BOILER WORKS,

LANCASHIRE.

Prices and other particulars on application.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TOLL END BRICK-WORKS,

TIPTON, STAFFORDSHIRE.

SYSTEMATIC INVESTMENT IN PATENTS.

THE COMMERCIAL DEVELOPMENT OF PATENTED AND UNPATENTED INVENTIONS.

INVESTORS and INVENTORS are invited to apply for the Prospectus and Circular of the INVENTORS' AND GENERAL AGENCY, Limited, 76, Chancery Lane, London, W.C.

ANDREW GLENDINNING, Secretary.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.

SECOND EDITION.

Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:

ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.

Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.

Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

BELL'S ARTICULATING TELEPHONE.

A Lecturer can accept a few Engagements to Exhibit and Describe Prof. Bell's Telephone.—For terms, &c., apply to the Lecturer's Agents, Abbott, Barton, and Co., 269, Strand, W.C.

M. C. thanks the numerous applicants replying to his advertisement, one of whom he has selected.

Wanted, an Engagement in a Chemical Laboratory by a Chemist of four years' experience in chemical works and private laboratories.—Apply to X. Z., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Wanted, a Man who thoroughly understands making alum, sulphate alumina, &c.—Address, B. 164, care of Henry Greenwood, Advertising Agent, Liverpool.

Wanted a Chemist who fully understands the manufacture of Sulphuric and Phosphoric Acids.—Apply, stating age, experience, and salary expected, to W. and H. M. Goulding (Lim.) 25, Eden Quay, Dublin.

Bar Magnets, 4 ins. by 3-8ths, 2s 6d. the pair. Ferrotype Discs, 1s. per pair. Box-wood Reels, wound with No. 36 wire, 3s. the pair. Binding-screws, 3s. the dozen. No. 36 Silk-covered Wire, 4s. the ¼ lb. Double-line Wire, 2d. per yard: best quality ditto, 3d. per yard. Flexible Silk Double-Wire Cord, 4d. and 8d. per yard. Small Electric Bells, 7s. 6d. each. Electric Call-Bell, with Key, Switch, and Battery complete, £3 the two sets; Magnetic ditto, £4 4s. Orders over 5s. post or carriage free; EDWARD PATERSON, Electric Bell Works, 3, Bedford Court, Covent Garden, W.C. Illustrated Catalogue for Two Stamps.

THE TELEPHONE.

Arrangements for Exhibiting Prof. BELL'S ARTICULATING TELEPHONE can be made by applying to EDWARD PATERSON, Agent and Licencee, 3, Bedford Court, Covent Garden, W.C.

SUGAR REFINERY MANAGER.

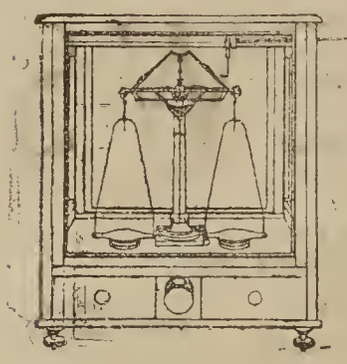
Wanted, in a Sugar Refinery at Liverpool, a competent Manager. He must be an able chemist, and an experienced, energetic man. Liberal terms.—Apply, in the first instance, by letter to Z., "Albion" Office, Sir Thomas's Buildings, Liverpool.

OFFICE FOR HOLLAND FOR CHEMICAL ANALYSES, NEW INVENTIONS, AND PATENTS,

146, Spuistraat, Amsterdam.

Branch in London.

Director—Dr. P. F. VON HAMEL ROOS.



L. OERTLING,

TURNMILL STREET

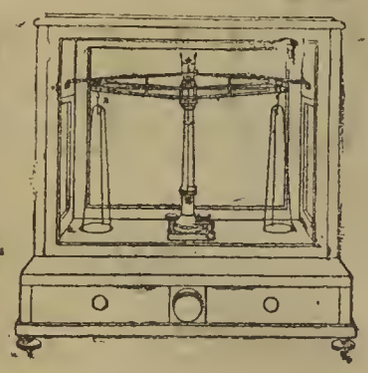
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

CHEMISTS AND MANUFACTURERS

Are solicited, before purchasing Filter-Presses, to examine the merits of

JOHNSON'S PATENT HYDRAULIC FILTER,

And see whether, for—

CORRECTNESS OF PRINCIPLE,
DESIGN,
CONVENIENCE AND ECONOMY IN WORKING,
SOLIDITY AND EXCELLENCE OF WORKMANSHIP,
AND LOWNESS OF PRICE,

it is not by far the Best, Cheapest, and Most Rapid means of Filtration in the Market, for—

SEPARATING SOLIDS FROM SEMI-FLUIDS,
FILTERING LIQUIDS BRIGHT,
WASHING PRECIPITATES,
DRYING PRECIPITATES SLURRY OR SLUDGE,

in any quantities, large or small, with great economy in cloths, which never burst and are easily removed for cleaning when required. These are advantages which command its adoption over every other form of Filter.

Trials at the Works made Gratis in presence of Intending Purchasers.

Small Filter-Press for Laboratory Use, with Pump complete ... ... from £7.

JOHNSON'S ENGINEERING WORKS,

CARPENTER'S ROAD, STRATFORD.

London Offices - - - - - - N. NUTTER, 71, Cornhill, E.C.

BURGOYNE, BURBIDGES, CYRIAX, & FARRIES,
Manufacturing and Operative Chemists,
16, COLEMAN STREET, E.C.
(Prize Medal Paris Exhibition, 1867).

Manufacturers of every description of Pure Acids, Chemicals, and Reagents for Analytical Purposes and Scientific Research.
Sole Agents for C. A. KAHLBAUM, Berlin.

Price Lists and Special Quotations upon application.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

JAMES WOOLLEY, SONS, & CO.

69, MARKET STREET, MANCHESTER,

DEALERS IN

CHEMICAL AND SCIENTIFIC APPARATUS
CHEMICAL REAGENTS, &c.,

FOR THE USE OF

Analysts, Science Teachers, and Manufacturers

Price Lists on application.

Methylated Spirits.—David Smith Kidd
Licensed Maker, Commercial Street, Shoreditch, N.E
Also FINISH, FUSEL OIL and RECT. NAPHTHA.

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ar wick Chemica l Works Manchester.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Galvanising Salts, Coal-Tar, Pitch Creosote, Grease, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,
ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,
BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.
Bessemer Steel Rail Plant.
Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.
Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.
Gas Producers Patent for Heating and other Purposes.
Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.
Patent Rousing Machinery for Brewers.
Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.
Steam Superheaters improved for Oil, Tar, and Resin Refining.
Steam Sulphur Melter.
Stills for Oil, Resin, and Tar.
Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY
LANCASHIRE.

MILTON CHEMICAL WORKS,
STOKE-ON-TRENT,
STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish. Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Special Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

---

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

PURE FATTY ACIDS.—I am anxious to obtain Specimens of any of the Pure Fatty Acids. Small quantities of One or Two Grammes would be sufficient. I shall be glad to purchase, or, if preferred, to make any other suitable acknowledgment in my power.—W. H. HATCHER, Price's Patent Candle Company (Limited), Belmont Works, Battersea, London, S.W.

BISULPHIDE OF CARBON,
PROTOSULPHATE,
RED OXIDE
OXYCHLORIDE
Sulphocyanide,
And every other Mercurial Preparation.

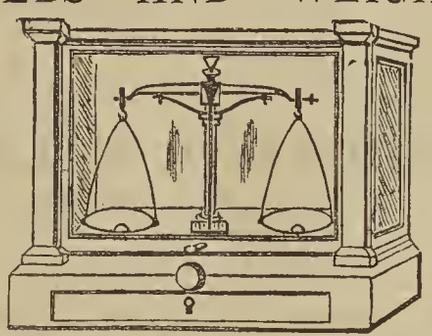
BISULPHITE OF LIME, TETRACHLORIDE OF CARBON,
Oxysulphuret of Antimony, Glacial Acetic Acid,

LIQUOR AMMONIÆ,
SULPHIDE OF IRON,
PURE ACIDS,
CHLORIDE OF SULPHUR,
ACETONE,
CHLOROFORM,
ALDEHYDE,
CHLORATE BARYTA,
ARSENIC ACIDS,
FRUIT ESSENCES FOR CONFECTIONERY & LIQUEURS,
PERCHLORIDE OF IRON,
SULPHITE AND HYPOSULPHITE OF SODA,
PHOSPHATES OF SODA AND AMMONIA,
ETHERS,
BROMIDES,
IODIDES,
SCALE AND GRANULAR PREPARATIONS.

ALSO,
Pure Photographic Chemicals of every kind.
MANUFACTURED BY
WILLIAM BAILEY & SON,
HORSELEY FIELDS CHEMICAL WORKS,
WOLVERHAMPTON

BECKER & SONS,
MANUFACTURERS OF
CHEMICAL AND GOLD ASSAY BALANCES
AND OTHER
SCALES AND WEIGHTS.

ROTTERDAM.



NEW YORK.

BECKER'S STUDENT'S BALANCE, in polished mahogany glass case, sliding front, counterpoised, to carry 30 grammes in each pan and turn to ½ milligramme, nickel plated pans.. £2 10
Ditto, ditto, in mahogany glass case, polished black £2 13

Sole Agents for England, Ireland, and Wales:—
TOWNSON & MERCER,

Becker's Complete Lists forwarded by post on receipt of 1*d.* stamp, or free on application.

South London School of Pharmacy, 325, Kennington Road. Managing Director, DR. MUTER.
Daily Lectures on the following subjects:—

CHEMISTRY.	MATERIA MEDICA.
BOTANY.	PHARMACY.
PHYSICS.	CLASSICS.

The School has accommodation for 120 Students, and contains a excellent Museum and a very completely fitted Chemical Laboratory for 50 Junior and 20 Senior Pupils, with water and gas at everyworking bench.

For all particulars, enclose a stamped envelope to the Secretary, Mr. W. BAXTER, at his office, Central Public Laboratory, Kennington Cross, London, S.E.

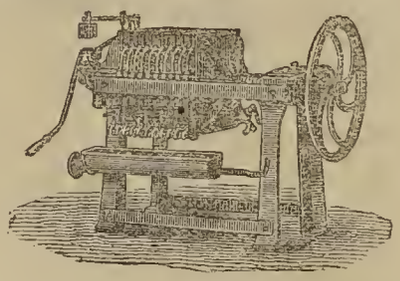
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

The speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING, and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE	Lump, Crystallised, Ground, and Prepared Large stock of every description. *** *Suitable for all Trades.*
ARSENIC	Refined powdered, Lump, Grey, and Ruby.
FLUOR-SPAR	Finest produced. Medium and Common for all purposes.
BARYTES	Carbonate and Sulphate. All qualities of Lump and Ground.
BAUXITE	Of high percentage of Alumina and low in Iron.

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

ERECTION OF PLANT.

TO SULPHATE OF AMMONIA MANUFACTURERS AND OTHERS.

STILLS, SATURATORS, and all APPARATUS in connection with the above Erected upon the Most Approved Plan—result of 15 years practical experience.—Address, G. Tunbridge, Man. Chem. Dept., Gas Works, Leicester, or J. Barnes, Plumber, &c., Barking, Essex.

F. W. BERK & CO.,

18, CULLUM STREET, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.

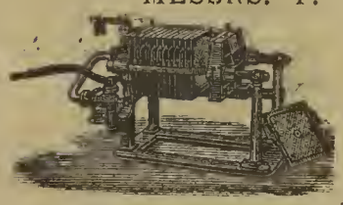
SULPHATE OF AMMONIA, ANTHRACENE
BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

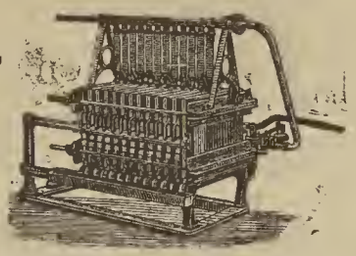
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 18, CULLUM STREET, LONDON,



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	a.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
e Agents for Prof. Wanklyn's Test Solutions or Water Analysi

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works, Ironbrid

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM
FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA
FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

Manufactured by the
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.
Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

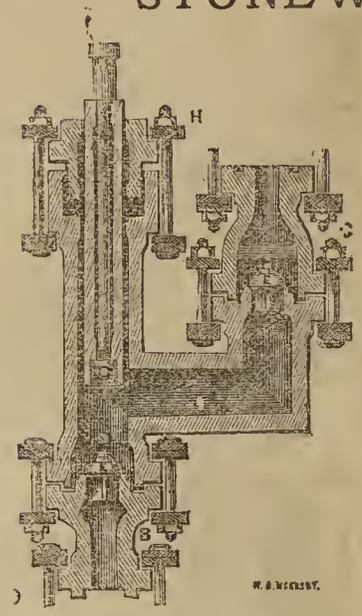
TAR DISTILLERS
DRYSALTERS
BOUCK & Co LIMITED
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp Zinc. Nitric Acids &c &c
BRIMSTONE REFINERS
Samples & prices on application.
J. J. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID. PICRIC ACID, Sal-Acetosell. BICHROME CHLORATE OF POTASH. &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

DOULTON & WATTS

HIGH STREET, LAMBETH, LONDON, S.E.

MANUFACTURERS OF

STONEWARE ACID PUMPS AND COCKS,

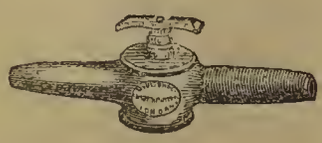


STILLS, RETORTS, CONDENSING WORMS

WOLFF'S BOTTLES

PERCOLATORS, AIR-TIGHT JARS,

And every description of Stoneware or Chemical Purposes, warranted to resist the strongest acids.



PLUMBAGO CRUCIBLES AND OTHER FIRE-STANDING GOODS.

CHEMISTS' & DRUGGISTS' GLASS. PORCELAIN TAPS

Price Lists of any of the above, and of every description of Stoneware, may be had on application.

Messrs. D. and W. were awarded a MEDAL for ACID PUMPS, and also one for PLUMBAGO CRUCIBLES, at the Vienna Exhibition, 1873.

Head Offices and Show Rooms, HIGH STREET, LAMBETH, S.E.

Depots :—Granville Wharf, Wood Street, Birmingham; 100, Soho Street, Liverpool ; Hope Street, Salford Manchester ; and 6, Rue de Paradis Poissonière, Paris.

FACTORIES: Reddish and Bradfoid, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

MANUFACTURERS OF

TOWN OFFICES : 61, Piccadilly, MANCHESTER.

PURE CARBOLIC ACID, Cryst. at 42°·2 C.	Discovered by C. Lowe.	CARBOLIC ACID GLYCERINE SOLUTIONS.
,, ,, do. Hydrate of		CRESYLIC ACID.
MEDICINAL do. Cryst. at 35° C.		SULPHO-PHENIC ACID (CRYST.
COMMERCIAL do. No. 1 ,, 35° C.		SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.
,, do. 2 ,, 29° C.		
,, do. 3 ,, 12° C.		
,, do. 4 liquid at 0° C.		
CARBOLIC ACID DISINFECTING POWDER.		

BENZOL (Cryst.).
ANTHRACENE.
NAPHTHALINE.
PICRIC ACID (Crystal and Paste).
AURINE (Rosolic Acid Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesa and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,

OLDBURY, NEAR BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purpose Anthracene, Naphthaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF,

STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
No. IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY
RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate Hill E.C January 25, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S. (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") *Established Twenty-six Years.*

Vol. 37.—No. 949. *Copyright reserved.* Friday, February 1, 1878. *Registered as a Newspaper.* PRICE, 4*d*. POST FREE, 4½*d*.

OF GREAT BRITAIN

CONTENTS.

ARTICLES:— PAGE
On Dyer's Chemicals, by J. Marzell 43
On the Estimation of the Nitrogen Compounds in the Oil of Vitriol of Commerce, by George E. Davis 45
On the Law of the Absorption of Radiations Across bodies, and of its Application in Quantitative Special Analysis, by M. G. Govi 46
Suspension, Solution, and Chemical Combination, by William Durham, F.R.S.E. 47
On the Presence of Oxygen in the Bessemer Metal, by Sergius Kern, M.E. 48
PROCEEDINGS OF SOCIETIES:—
MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.—Note on the Decomposition of Water by Iron Pyrites 49
NOTICES OF BOOKS.—Annual Report of the Board of Regents of the Smithsonian Institution—Pollen 49
CORRESPONDENCE.—Aroma of Butter—Institute of Chemistry... 50
CHEMICAL NOTICES FROM FOREIGN SOURCES 51

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

MACTEAR'S PATENT CARBONATING FURNACE,

MANUFACTURED BY

R. DAGLISH & CO.,

ST. HELEN'S ENGINE AND BOILER WORKS,

LANCASHIRE.

Prices and other particulars on application.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

SYSTEMATIC INVESTMENT IN PATENTS.

THE COMMERCIAL DEVELOPMENT OF PATENTED AND UNPATENTED INVENTIONS.

INVESTORS and INVENTORS are invited to apply for the Prospectus and Circular of the INVENTORS' AND GENERAL AGENCY, Limited, 76, Chancery Lane, London, W.C.
ANDREW GLENDINNING, Secretary.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

BELL'S ARTICULATING TELEPHONE.

A Lecturer can accept a few Engagements to Exhibit and Describe Prof. Bell's Telephone.—For terms, &c. apply to the Lecturer's Agents, Abbott, Barton, and Co., 269, Strand W.C.

A Chemist, with considerable experience in tar-distilling, anthracen purifying, and anthraquinon manufacture, seeks Re-engagement.—J. M., 314, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

An Anthraquinon and Alizarin Chemist wishes to get an Engagement.—R. S., 1001, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

CHEMISTRY.

A Master thoroughly acquainted with Heat and Electricity is wanted by a Military Gentleman, in or near London.—Address, O. C., Rice's Library, Mount Street, Grosvenor Square.

Wanted, a Youth for the Laboratory, one who has had two or three years' experience preferred.—Apply to the Bede Metal and Chemical Company, Limited, 3, St. Nicholas Buildings, Newcastle on Tyne.

Wanted, a First-Class Foreman for Chemical Manure Works in Ireland. Must have had large experience in the conducting of work.—Address, with references and stating wages required, K., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Wanted by Advertiser (21), Employment in a Chemical Laboratory as Assistant, or in any capacity where a good knowledge of Chemistry would be useful. Moderate salary required.—Address, Chemicus, 72, Alexander Road, Holloway, London.

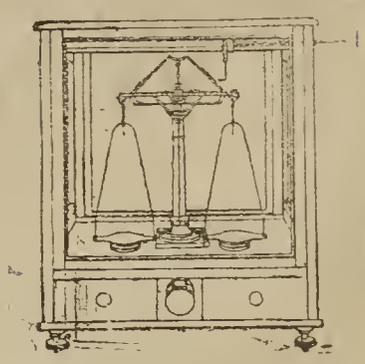
Chemist wanted.—H., care of Henry Scholefield, Esq, begs to inform numerous applicants that the vacancy is filled.

AGENCY.

A Technological and Analytical Chemist in the North, with a good connection, is open to accept Agencies for Specialities, Patent Processes, New Appliances and Apparatus, or of Raw and Manufactured Chemicals.—Address, first, to P. R., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

THE TELEPHONE.

Arrangements for Exhibiting Prof. BELL'S ARTICULATING TELEPHONE can be made by applying to EDWARD PATERSON, Agent and Licencee, 3, Bedford Court, Covent Garden, W.C.



L. OERTLING,

TURNMILL STREET

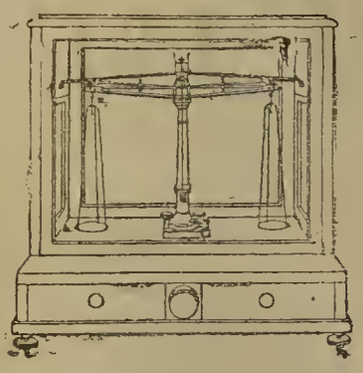
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

BURGOYNE, BURBIDGES, CYRIAX, & FARRIES,

MANUFACTURING AND OPERATIVE CHEMISTS,

16, COLEMAN STREET, E.C.

(Prize Medal Paris Exhibition, 1867).

Manufacturers of every description of Pure Acids, Chemicals, and Reagents for Analytical Purposes and Scientific Research.

Sole Agents for C. A. KAHLBAUM, Berlin.

Price Lists and Special Quotations upon application.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

BISULPHITE OF LIME.

BISULPHITE OF SODA.

WILLIAM MARRIOTT

CHEMICAL WORKS HUDDERSFIELD

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ar wick Chemical Works Manchester.

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS, LIQUOR AMMONIA, &c.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA.

MINERALS, FOSSILS, AND ROCKS.

JAMES R. GREGORY'S

NEW AND EXTENSIVE SHOW-ROOMS,

88, Charlotte Street, Fitzroy Square, London, W.

COLLECTIONS especially prepared for teaching purposes, at all prices from half-a-guinea upwards. Also single specimens, Geological Hammers, Cabinets, Books, Glass-topped Boxes, &c.

Detailed Catalogues (74 pages) free for six stamps.

H. M. CAPNER,

Electrical and Philosophical Instrument Maker to the Trade only.

20, NORTHAMPTON SQUARE, LONDON E.C

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays.. ..	£2	2 0
200 Specimens, in Cabinet, with 5 Trays.. ..	5	5 0
300 Specimens, in Cabinet, with 9 Drawers ..	10	10 0
400 Specimens, in Cabinet, with 13 Drawers ..	21	0 0

More extensive Collections at 50 to 5000 Guineas each.

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, Londo

F. W. BERK & CO.,

18, CULLUM STREET, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.

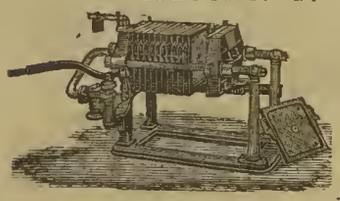
SULPHATE OF AMMONIA, ANTHRACENE
BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

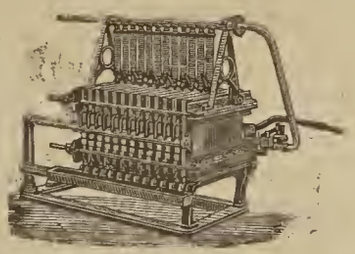
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 18, CULLUM STREET, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

TOWNSON & MERCER
(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
e Agents for Prof. Wanklyn's Test Solutions or Water Analysi

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works, Ironbrid

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM
FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA
FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

Manufactured by the
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.
Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

TAR DISTILLERS
DRYSALTERS
BOUCK & Co. LIMITED
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp Zinc, Nitric Acids &c.&c.
BRIMSTONE REFINERS
Samples & prices on application.
J.I. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID, PICRIC ACID, Sal-Acetosella BICHROME CHLORATE OF POTASH, &c.&c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

CALVERT'S CARBOLIC ACID.

HIGHEST PRIZE MEDAL AT PARIS EXHIBITION, 1867.

GOLD AND SILVER MEDALS, HAVRE, 1868. DIPLOME D'EXCELLENCE, AMSTERDAM

SILVER MEDAL, FIRST CLASS, NAPLES, 1871. GOLD MEDAL, MOSCOW, 1872.

F. C. CALVERT & CO., of Bradford, Manchester (original and only Manufacturers of pure Medical Carbolic Acid), beg to inform the Trade and large Consumers that their pure Medical Carbolic as well as cheape qualities for Commercial, Veterinary, and Disinfecting Purposes, also Carbolic Acid Soaps for Medical, Toilet, and General Use, Soft Soap o Dogs, and Carbolic Acid Disinfecting Powder, may be had from any of the below-named Wholesale Agents—

Apothecaries' Soc., Lond'n	Clarke, Bleasdale, & Co.	Hodgkinsons, Freston, & King	W. Mather	James Sim & Co,
Apothecaries' Co., Glasg'w	Clay, Dod, & Case	Hearon, Squire, & Francis	McMaster, Hodgson, & Co.	Sang & Barker
Apothecaries' Hall, Dublin	Dakin Brothers	Hopkin & Williams	J. F. Macfarlan & Co.	Southall, Bros., & Co.
Allen & Hanburys	Davy, Yates, & Co.	Howards & Sons	J. Mackay	W. Smeeton
J. Bell & Co.	Duncan, Flockhart, & Co.	Hirst, Brooke, & Co.	R. H. Millard & Son	Slinger & Barnett
Barron, Harveys, & Co.	W. Edwards & Son	W. R. Hatrick & Co.	Mackey, Sellers, & Co.	P. Sandeman & Co.
Barclay & Sons.	Evans, Lescher, & Evans	P. Harris & Co.	Mottershead & Co.	Tidman & Son
Burgoyne & Co.	Evans, Sons, & Co.	Hunt & Co.	Newbery & Sons	Taylor, Gibson, & Co.
Baiss Brothers & Co.	Evans, Gadd, & Co.	J. Ismay	Paterson & Son	Thacker & Hoffe
Barron, Squire, & Co.	Ferris & Co.	Johnson & Sons	Raimes & Co.	Jas. Taylor
Battley & Watts	Glasgow New Apoth. Co.	Langtons, Edden, & Hicks	J. Richardson & Co.	J. Woolley, Sons, & Co
Bewley & Draper	General Apothecaries' Co.	Lynch & Co.	Raimes, Blanshards, & Co.	Wyleys & Co.
H. B. Brady	W. & H. M. Goulding	Lofthouse & Saltmer	J. Reddish & Co.	Wilson & Kitchen
Bainbridge & Pound	Goodall, Backhouse, & Co.	Chas. Leslie	Sanger & Sons	C. H. Warner & Co.
Boileau & Boyd	Grimwade, Ridley, & Co.	Maw, Son, & Thompson	Savory & Moore.	A. & J. Warren
Curling & Co.	Hodgkinsons, Stead, & Co.	H. C. Mason	W. Sutton & Co.	Walkington & Son
Corbyn & Co.	Herrings & Co.		R. Sumner & Co.	Wright, Layman, & Umney

MILTON CHEMICAL WORKS, STOKE-ON-TRENT, STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Special Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

S. A. SADLER, CLEVELAND CHEMICAL WORKS, MIDDLESBROUGH;

Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Galvanising Salts, Coal-Tar, Pitch Creosote, Grease, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

MANUFACTURERS OF

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

PURE CARBOLIC ACID, Cryst. at 42°·2 C.	Discovered by C. Lowe.	CARBOLIC ACID GLYCERINE SOLUTIONS.	BENZOL (Cryst.).
,, ,, do. Hydrate of		CRESYLIC ACID.	ANTHRACENE.
MEDICINAL do. Cryst. at 35° C.		SULPHO-PHENIC ACID (CRYST.	NAPHTHALINE.
COMMERCIAL do. No. 1 ,, 35° C.		SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.	PICRIC ACID (Cryst and Paste).
,, do. 2 ,, 29° C.			AURINE (Rosolic Acid Cake and Solution.
,, do. 3 ,, 12° C.			
,, do. 4 liquid at 0° C.			
CARBOLIC ACID DISINFECTING POWDER.			

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesa and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO., OLDBURY, NEAR BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purpose Anthracene, Naphthaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF, STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
& IMPERIAL POTTERIES, LAMBETH.

OLD QUAY RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate Hill E.C Febuary 1, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S. (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") *Established Twenty-six Years.*

Vol. 37.—No. 950. *Copyright reserved.* Friday, February 8, 1878. *Registered as a Newspaper.* PRICE, 4*d*. POST FREE, 4½*d*

CONTENTS.

	PAGE
ARTICLES:—	
On Dyer's Chemicals, by J. Marzell	53
Preliminary Notice of a New Yellow Colouring Matter, by Raphael Meldola	56
On the Manufacture of Iodine, Bromine, and Nitrate of Potash together with Soda, by the Ammonia Process, by Thorwald Schmidt	56
PROCEEDINGS OF SOCIETIES:—	
INSTITUTE OF CHEMISTRY OF GREAT BRITAIN AND IRELAND	57
ROYAL INSTITUTION OF GREAT BRITAIN	59
PHYSICAL SOCIETY	59
EDINBURGH UNIVERSITY CHEMICAL SOCIETY	60
NOTICES OF BOOKS	60
CORRESPONDENCE	61
CHEMICAL NOTICES FROM FOREIGN SOURCES	61

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

MACTEAR'S PATENT CARBONATING FURNACE,

MANUFACTURED BY

R. DAGLISH & CO.,

ST. HELEN'S ENGINE AND BOILER WORKS,

LANCASHIRE.

Prices and other particulars on application.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TOLL END BRICK-WORKS,

TIPTON, STAFFORDSHIRE.

SYSTEMATIC INVESTMENT IN PATENTS.

THE COMMERCIAL DEVELOPMENT OF PATENTED AND UNPATENTED INVENTIONS.

INVESTORS and INVENTORS are invited to apply for the Prospectus and Circular of the INVENTORS' AND GENERAL AGENCY, Limited, 76, Chancery Lane, London, W.C.

ANDREW GLENDINNING, Secretary.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.

SECOND EDITION.

Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:

ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.

Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.

Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

Just published, price One Shilling,

TELEPHONE, OLD AND NEW.

A Lecture by Professor BARRETT, M.R.I.A.

With Notes and Illustrations.

London: HORATIO YEATES, Optical and Philosophical Instrument Maker, 33, King Street, Covent Garden.

BELL'S ARTICULATING TELEPHONE.

A Lecturer can accept a few Engagements to Exhibit and Describe Prof. Bell's Telephone.—For terms, &c. apply to the Lecturer's Agents, Abbott, Barton, and Co., 269, Strand W.C.

THE TELEPHONE.

Arrangements for Exhibiting Prof. BELL'S ARTICULATING TELEPHONE can be made by applying to EDWARD PATERSON, Agent and Licencee, 3, Bedford Court, Covent Garden, W.C.

TO BE SOLD.

A Practical, Experienced, and Advantageous Proceeding for the Fabrication of Cinnabar.—Apply to Td. 10, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London E.C.

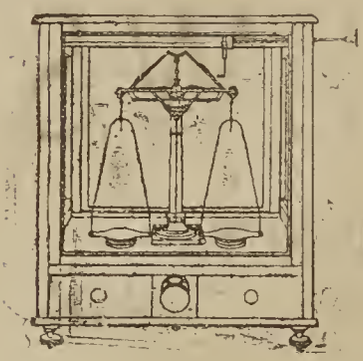
A Young Gentleman, of Five Years' Experience, desires a Situation as Analyst, Sanitary or Manufacturing.—Address, E. W. R., 29, Park Road, Haverstock Hill, N.W.

A Chemist (22) who has studied for Four Years under the first Professors in England and Germany, desires an Engagement in Chemical Works or in a Laboratory. Moderate salary. Very highest references and testimonials.—Address, ORCIN, care Holmes's Library, Chapel Place, Oxford Street, W.

Wanted, a Practical Chemist, who thoroughly understands Spent Oxide of Iron and the Manufacture of its Products, by a Firm who use it largely in producing Sulphuric Acid.—Address, stating salary and experience, to B26, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Wanted immediately, in the Laboratory of an Analytical Chemist in the City, a careful, trustworthy Assistant, capable of performing accurate Commercial work. Preference given to a gentleman of practical experience in Agricultural Analyses.—Apply by letter, stating age, experience, and salary required, to ALPHA, care of Messrs. Everett and Son, 17, Royal Exchange, E.C.

Wanted, a First-Class Foreman for Chemical Manure Works in Ireland. Must have had large experience in the conducting of work.—Address, with references and stating wages required, K., CHEMICAL NEWS Office, Boy Court, Ludgate Hill London, E.C.



L. OERTLING,

TURNMILL STREET

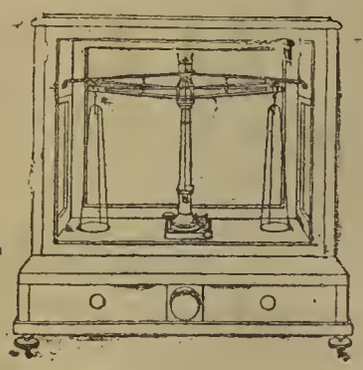
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ALABASTER AND CO.,

44, GLOUCESTER STREET, QUEEN SQUARE, W.C.,

MANUFACTURERS TO THE TRADE OF ALL KINDS OF

CHEMICAL AND ASSAY BALANCES.

BALANCES MADE WITH LONG OR SHORT BEAMS. STUDENTS' BALANCES AT ALL PRICES.

Illustrated Price Lists on application.

Chemical Apparatus & Scientific Instruments.

PORCELAIN, GLASS, STONE, WOOD, AND METAL APPARATUS

FOR

CHEMICAL AND PHILOSOPHICAL PURPOSES AND LECTURES.

ELECTRICAL, MEDICAL, AND EXPERIMENTAL COILS AND APPARATUS.

BUNSEN'S MODIFIED FILTER PUMPS, from 10s. 8d. to 67s.

ELECTRICAL BATTERIES AND ELEMENTS.

Sets of Apparatus according to Professor Valentin's "Book of Chemistry," and Professor Attfield's "Manual of Chemistry."

Also Sets of Apparatus as required by the Government Schools always ready and kept in stock.

Catalogues and Illustrations will be sent Gratuitously. A Liberal Discount allowed to Wholesale Buyers.

WHOLESALE IMPORTERS AND MANUFACTURERS:

AUG. BEL & CO.,

34, Maiden Lane, Strand, London, W.C.

SOLE AGENTS FOR GRENET'S BATTERIES AND NODOT'S MICROSCOPES.

BURGOYNE, BURBIDGES, CYRIAX, & FARRIES,

MANUFACTURING AND OPERATIVE CHEMISTS,

16, COLEMAN STREET, E.C.

(Prize Medal Paris Exhibition, 1867).

Manufacturers of every description of Pure Acids, Chemicals, and Reagents for Analytical Purposes and Scientific Research.

Sole Agents for C. A. KAHLBAUM, Berlin.

Price Lists and Special Quotations upon application.

JAMES WOOLLEY, SONS, & CO.

69, MARKET STREET, MANCHESTER,

DEALERS IN

CHEMICAL AND SCIENTIFIC APPARATUS

CHEMICAL REAGENTS, &c.,

FOR THE USE OF

ANALYSTS, SCIENCE TEACHERS, AND MANUFACTURERS

Price Lists on application.

MINERALS, FOSSILS, AND ROCKS.

JAMES R. GREGORY'S

NEW AND EXTENSIVE SHOW-ROOMS,

88, Charlotte Street, Fitzroy Square, London, W.

COLLECTIONS especially prepared for teaching purposes, at all prices from half-a-guinea upwards. Also single specimens, Geological Hammers, Cabinets, Books, Glass-topped Boxes, &c.

Detailed Catalogues (74 pages) free for six stamps.

A. BOAKE & CO.,

STRATFORD, LONDON, E.,

MAKERS OF

THE SULPHITES AND BISULPHITES

OF

SODA AND LIME.

BISULPHIDE OF CARBON,
PROTOSULPHATE,
RED OXIDE
OXYCHLORIDE

Sulphocyanide,
And every other Mercurial Preparation.

BISULPHITE OF LIME, TETRACHLORIDE OF CARBO N
Oxysulphuret of Antimony, Glacial Acetic Acid,

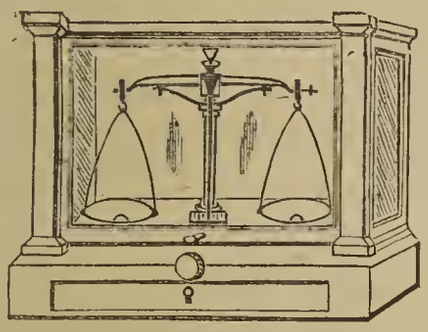
LIQUOR AMMONIÆ,
SULPHIDE OF IRON,
PURE ACIDS,
CHLORIDE OF SULPHUR,
ACETONE,
CHLOROFORM,
ALDEHYDE,
CHLORATE BARYTA,
ARSENIC ACIDS,
FRUIT ESSENCES FOR CONFECTIONERY & LIQUEURS,
PERCHLORIDE OF IRON,
SULPHITE AND HYPOSULPHITE OF SODA,
PHOSPHATES OF SODA AND AMMONIA,
ETHERS,
BROMIDES,
IODIDES,
SCALE AND GRANULAR PREPARATIONS.

ALSO,
Pure Photographic Chemicals of every kind.
MANUFACTURED BY
WILLIAM BAILEY & SON,
HORSELEY FIELDS CHEMICAL WORKS,
WOLVERHAMPTON

BECKER & SONS,

MANUFACTURERS OF
CHEMICAL AND GOLD ASSAY BALANCES
AND OTHER
SCALES AND WEIGHTS.

ROTTERDAM.



NEW YORK.

BECKER'S STUDENT'S BALANCE, in polished mahogany glass case, sliding front, counterpoised, to carry 30 grammes in each pan and turn to ½ milligramme, nickel plated pans.. £2 10
Ditto, ditto, in mahogany glass case, polished black £2 13

Sole Agents for England, Ireland, and Wales :—
TOWNSON & MERCER,

Becker's Complete Lists forwarded by post on receipt of 1*d.* stamp, or free on application.

South London School of Pharmacy, 325, Kennington Road. Managing Director, DR. MUTER.
Daily Lectures on the following subjects:—

CHEMISTRY. MATERIA MEDICA.
BOTANY. PHARMACY.
PHYSICS. CLASSICS.

The School has accommodation for 120 Students, and contains a excellent Museum and a very completely fitted Chemical Laboratory for 50 Junior and 20 Senior Pupils, with water and gas at every working bench.

For all particulars, enclose a stamped envelope to the Secretary, Mr. W. BAXTER, at his office, Central Public Laboratory, Kennington Cross, London, S.E.

APPARATUS AND CHEMICALS

FOR USE IN
LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.
MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,
BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Salt Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.
Bessemer Steel Rail Plant.
Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.
Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.
Gas Producers Patent for Heating and other Purposes.
Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.
Patent Rousing Machinery for Brewers.
Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.
Steam Superheaters improved for Oil, Tar, and Resin Refining.
Steam Sulphur Melter.
Stills for Oil, Resin, and Tar.
Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY
LANCASHIRE.

EARP & CHASTER,

RUNCORN,
MAKERS OF
CHEMICALLY PURE MINERAL ACIDS
LIQUOR AMMONIA, &c.

Methylated Spirits.—David Smith Kidd
Licensed Maker, Commercial Street, Shoreditch, N.E
Also FINISH, FUSEL OIL and RECT. NAPHTHA.

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

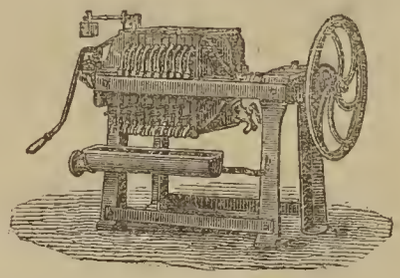
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

THE speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING, and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE	Lump, Crystallised, Ground, and Prepared Large stock of every description. *** *Suitable for all Trades.*
ARSENIC	Refined powdered, Lump, Grey, and Ruby.
FLUOR-SPAR	Finest produced. Medium and Common for al purposes.
BARYTES	Carbonate and Sulphate. All qualities of Lump and Ground.
BAUXITE	Of high percentage of Alumina and low in Iron:

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

ERECTION OF PLANT.

TO SULPHATE OF AMMONIA MANUFACTURERS AND OTHERS.

STILLS, SATURATORS, and all APPARATUS in connection with the above Erected upon the Most Approved Plan—result of 15 years practical experience.—Address, G. Tunbridge, Man. Chem. Dept., Gas Works, Leicester, or J. Barnes, Plumber, &c., Barking, Essex.

F. W. BERK & CO.,

18, CULLUM STREET, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

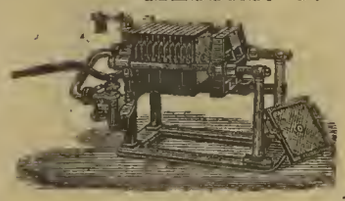
POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

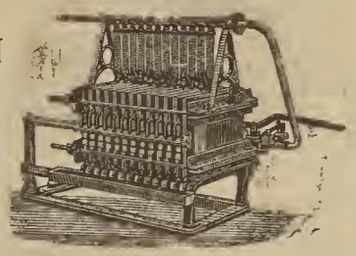
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 18, CULLUM STREET, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
e Agents for Prof. Wanklyn's Test Solutions or Water Analysi

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

Manufactured by the
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.
Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

TAR DISTILLERS
DRYSALTERS
BOUCK & Co LIMITED
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp Zinc. Nitric Acids &c &c.
BRIMSTONE REFINERS
Samples & prices on application.
J. I. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID, PICRIC ACID, Sal-Acetosell BICHROME CHLORATE OF POTASH, &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

DOULTON & WATTS

HIGH STREET, LAMBETH, LONDON, S.E.

DEPOTS:—GRANVILLE WHARF, WOOD STREET, BIRMINGHAM; 100, SOHO STREET LIVERPOOL; AND 18, RUE MARTEL, PARIS.

MANUFACTURERS OF

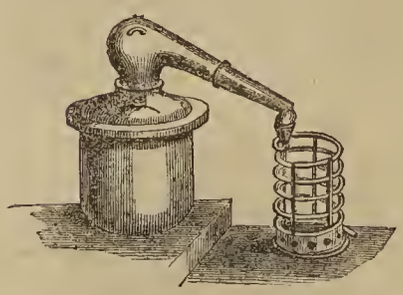
STILLS, RETORTS, CONDENSING WORMS, WOLLF'S BOTTLES

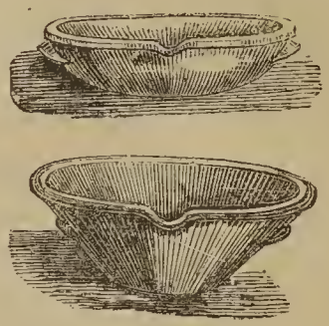
ACID PUMPS, COCKS, PERCOLATORS, AIR-TIGHT JARS,

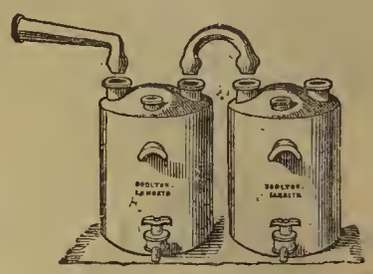
AND EVERY DESCRIPTION OF

STONEWARE FOR CHEMICAL PURPOSES,

Warranted to Resist the Strongest Acids.







PLUMBAGO CRUCIBLES, AND OTHER FIRE-STANDING GOODS.

CHEMISTS' AND DRUGGISTS' GLASS. PORCELAIN TAPS.

PRICE LISTS of any of the above, and of Every Description of Stoneware, may be had on application, and Samples seen at

Messrs. D. and W.'s SHOW ROOMS, HIGH STREET, LAMBETH.

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

MANUFACTURERS OF

PURE CARBOLIC ACID, Cryst. at 42°·2 C. } Discovered by C. Lowe.	CARBOLIC ACID GLYCERINE SOLUTIONS.	BENZOL (Cryst.).
,, ,, do. Hydrate of	CRESYLIC ACID.	ANTHRACENE.
MEDICINAL do. Cryst. at 35° C.	SULPHO-PHENIC ACID (CRYST.	NAPHTHALINE.
COMMERCIAL do. No. 1 ,, 35° C.	SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.	PICRIC ACID (Cryst and Paste).
,, do. 2 ,, 29° C.		AURINE (Rosolic Acid Cake and Solution.
,, do. 3 ,, 12° C.		
,, do. 4 liquid at 0° C.		
CARBOLIC ACID DISINFECTING POWDER.		

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,

OLDBURY, NEAR BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purpose Anthracene, Naphthaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF,

STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
No. IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY
RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate Hill E.C
Febuary 8, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

[Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [Established Twenty-six Years.

Vol. 37.—No. 951.] Copyright reserved. Friday, February 15, 1878. Registered as a Newspaper. [PRICE, 4d. POST FREE, 4½d

CONTENTS.

ARTICLES:— PAGE
Method of Obtaining the Copper from Copper Pyrites with the Aid of Two Waste Products, by Hugh M. Wilson 65
Some Remarks on the Metal Davyum, by Sergius Kern, M.E... 65
Application of Organic Acids to the Examination of Minerals, by H. Carrington Bolton 65
PROCEEDINGS OF SOCIETIES:—
CHEMICAL SOCIETY.—The Alkaloids of the Aconites—Notes on the Tannins—On the Estimation of Phosphorus in Iron and Steel—An Inquiry into the action of the Copper-zinc Couple on Alkaline Oxysalts—On a New Method for the Determination of Boiling-Points..... 67
NOTICES OF BOOKS.—Experimental Researches in Pure, Applied, and Physical Chemistry..... 69
CORRESPONDENCE 72
CHEMICAL NOTICES FROM FOREIGN SOURCES..... 73

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

SYSTEMATIC INVESTMENT IN PATENTS.

THE COMMERCIAL DEVELOPMENT OF PATENTED AND UNPATENTED INVENTIONS.

INVESTORS and INVENTORS are invited to apply for the Prospectus and Circular of the INVENTORS' AND GENERAL AGENCY, Limited, 76, Chancery Lane, London, W.C.

ANDREW GLENDINNING, Secretary.

FILTER-PRESSES.

JOHN BEVERLEY and SON, ST. COLUMBA WORKS, WOODHOUSE LANE, LEEDS,

Manufacture FILTER-PRESSES which for Price and Workmanship compare favourably with those of other English and Foreign makers.—Prices, &c., on application.

DIAPHRAGM PUMPS, STEAM-ENGINES, AIR-COMPRESSORS, MONTS DE JUS, &c.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street, Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

Just published, price One Shilling,

TELEPHONES, OLD AND NEW.
A Lecture by Professor BARRETT, M.R.I.A.
With Notes and Illustrations.
London: HORATIO YEATES, Optical and Philosophical Instrument Maker, 33, King Street, Covent Garden.

THE TELEPHONE.

Arrangements for Exhibiting Prof. BELL'S ARTICULATING TELEPHONE can be made by applying to EDWARD PATERSON, Agent and Licencee, 3, Bedford Court, Covent Garden, W.C.

AGENCY.

A Technological and Analytical Chemist in the North, with a good connection, is open to accept Agencies for Specialities, Patent Processes, New Appliances and Apparatus, or of Raw and Manufactured Chemicals.—Address, first, to P. R., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Wanted, a Practical Chemist, who thoroughly understands Spent Oxide of Iron and the Manufacture of its Products, by a Firm who use it largely in producing Sulphuric Acid.—Address, stating salary and experience, to B26, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Situation Wanted, as General Foreman or Engineer and Plumber, in Manure, Acid, and Sulphate Works. Good references as to ability for the same.—W. J., 38, Mostyn Road, North Bow, London, E.

WATER ANALYSIS.—Prof. WANKLYN, Lecturer on Chemistry and Physics at St. George's Hospital, Public Analyst for Buckinghamshire, Buckingham, High Wycombe Peterborough, and Shrewsbury, has REMOVED to 7 Westminster Chambers, Victoria Street, S.W

To Chemists and Aërated Water Manufacturers.

For Sale, at £500, being one-fourth of the cost, LEASE, STOCK, GAS-ENGINE, and MACHINERY complete. Rent £65.—Apply at 4, Montpelier Street, Brompton.

MACTEAR'S PATENT CARBONATING FURNACE,

AND

JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,

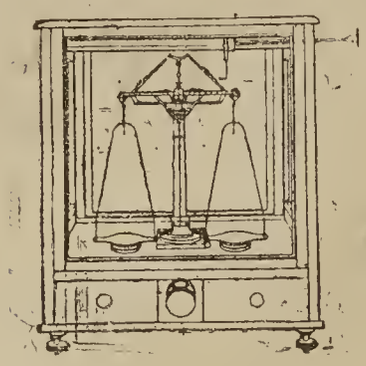
MANUFACTURED BY

R. DAGLISH & CO.,

ST. HELEN'S ENGINE AND BOILER WORKS,

LANCASHIRE.

Prices and other particulars on application.



L. OERTLING,

TURNMILL STREET

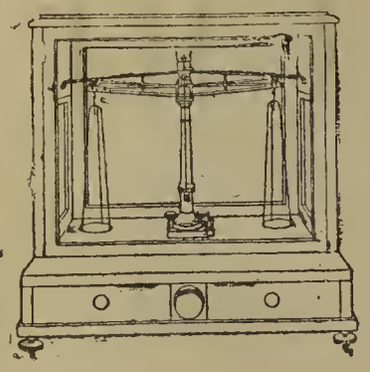
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

CALVERT'S CARBOLIC ACID.

HIGHEST PRIZE MEDAL AT PARIS EXHIBITION, 1867.

GOLD AND SILVER MEDALS, HAVRE, 1868. DIPLOME D'EXCELLENCE, AMSTERDAM

SILVER MEDAL, FIRST CLASS, NAPLES, 1871. GOLD MEDAL, MOSCOW, 1872.

F. C. CALVERT & CO., of Bradford, Manchester (original and only Manufacturers of pure Medical Carbolic Acid), beg to inform the Trade and large Consumers that their pure Medical Carbolic as well as cheaper qualities for Commercial, Veterinary, and Disinfecting Purposes, also Carbolic Acid Soaps for Medical, Toilet, and General Use, Soft Soap o Dogs, and Carbolic Acid Disinfecting Powder, may be had from any of the below-named Wholesale Agents—

Apothecaries' Soc., Lond'n
Apothecaries' Co , Glasg'w
Apothecaries' Hall, Dublin
Allen & Hanburys
J. Bell & Co.
Barron, Harveys, & Co.
Barclay & Sons.
Burgoyne & Co.
Baiss Brothers & Co.
Barron, Squire, & Co.
Battley & Watts
Bewley & Draper
H. B. Brady
Bainbridge & Pound
Boileau & Boyd
Curling & Co.
Corbyn & Co.
Clarke, Bleasdale, & Co.
Clay, Dod, & Case
Dakin Brothers
Davy, Yates, & Co.
Duncan, Flockhart, & Co.
W. Edwards & Son
Evans, Lescher, & Evans
Evans, Sons, & Co.
Evans, Gadd, & Co.
Ferris & Co.
Glasgow New Apoth. Co.
General Apothecaries' Co.
W. & H. M. Goulding
Goodall, Backhouse, & Co.
Grimwade, Ridley, & Co.
Hodgkinsons, Stead, & Co.
Herrings & Co.
Hodgkinsons, Preston, & King
Hearon, Squire, & Francis
Hopkin & Williams
Howards & Sons
Hirst, Brooke, & Co.
W. R. Hatrick & Co.
P. Harris & Co.
Hunt & Co.
J. Ismay
Johnson & Sons
Langtons, Edden, & Hicks
Lynch & Co.
Lofthouse & Saltmer
Chas. Leslie
Maw, Son, & Thompson
H. C. Mason
W. Mather
McMaster, Hodgson, & Co.
J. F. Macfarlan & Co.
J. Mackay
R. H. Millard & Son
Mackey, Sellers, & Co.
Mottershead & Co.
Newbery & Sons
Paterson & Son
Raimes & Co.
J. Richardson & Co.
Raimes, Blanshards, & Co.
J Reddish & Co.
Sanger & Sons
Savory & Moore.
W. Sutton & Co.
R. Sumner & Co.
James Sim & Co,
Sang & Barker
Southall, Bros., & Co.
W. Smeeton
Slinger & Barnett
P. Sandeman & Co.
Tidman & Son
Taylor, Gibson, & Co.
Thacker & Hoffe
Jas. Taylor
J. Woolley, Sons, & Co
Wyleys & Co.
Wilson & Kitchen
C. H. Warner & Co.
A. & J. Warren
Walkington & Son
Wright, Layman, & Umney

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal- Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS, LIQUOR AMMONIA, &c.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA.

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

DO YOUR OWN PRINTING.

The "Optimus" Printing-Press for Amateurs. Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A HERBERT, Printing Warehouse, 50, Finsbury Square, London, E.C.

MEETINGS FOR THE WEEK.

SATURDAY, 16th.—Physical, 3. "On Grove's Gas Battery," H. F. Morley, M.A., B.Sc. "On the Drawing of Lissajous' Figures for the Stereoscope by his Pendulum Apparatus," S. C. Tisley. On the Same, Mr. Strop.
MONDAY, 18th.—Medical, 8.
—— Society of Arts, 8. "The Application of Photography to the Production of Printing Surfaces and Pictures in Pigment," T. Bolas, F.C.S.
—— London Institution, 5.
TUESDAY 19th.—Civil Engineers, 8.
—— Royal Institution, 3. "Protoplasmic Theory of Life, and its Bearing on Physiology," Professor Garrod.
—— Zoological, 8.30.
—— Society of Arts, 8. (African Section). "Egyptian Obelisks and their Relation to Chronology and Art," Basil H. Cooper, B.A.
WEDNESDAY, 20th.—Society of Arts, 8. "The Steam Tramways of Paris," J. L. Haddan, M.I.C.E.
—— Meteorological, 7. "Winter Climate of some English Sea-side Health Resorts," John W. Tripe, M.D. "Notes on a Waterspout," Capt. W. Watson. "Notes on the Occurrence of Globular Lightning and of Waterspouts in Co. Donegal, Ireland," M. Fitzgerald.
—— Society of Public Analysts, 8. "On the Fatty Metamorphosis of Caseine in Milk and Cheese," A. W. Blyth, M.R.C.S. "On an Adulteration of Milk which cannot be Detected by the Ordinary Process of Analysis," J. Muter, Ph.D., &c. "On a Numerical Scale for the Estimation of the Degree of Contamination of Drinking Waters as shown by the Results of the Analyses," G. W. Wigner, F.C.S. "Experiments on the Chemical Action of Chlorate of Potash on the System," Otto Hehner, F.C.S.
THURSDAY, 21st.—Royal, 8.30.
—— Royal Institution, 3. "Chemistry of the Organic World," Prof. Dewar.
—— London Institution, 7.
—— Zoological, 4.
—— Chemical, 8. "Laboratory Experiments on Board the *Challenger*," J. Y. Buchanan, F.R.S.E.
FRIDAY 22nd.—Royal Institution, 8. Weekly Meeting. "The New Metal Gallium," Prof. Odling, M.A.
—— Quekett Club, 8.
SATURDAY, 3rd.—Royal Institution, 3. "Carthage and the Carthaginians," R. Bosworth Smith, M.A.

OFFICE FOR HOLLAND FOR CHEMICAL ANALYSES, NEW INVENTIONS, AND PATENTS

146, Spuistraat, Amsterdam.

Branch in London.

Director—Dr. P. F. VON HAMEL ROOS.

Bar Magnets, 4 ins. by 3-8ths, 2s 6d. the pair. Ferrotype Discs, 1s. per pair. Box-wood Reels, wound with No. 36 wire, 3s. the pair. Binding-screws, 3s. the dozen. No. 36 Silk-covered Wire, 4s. the ¼ lb. Double-line Wire, 2d. per yard: best quality ditto, 3d. per yard. Flexible Silk Double-Wire Cord, 4d. and 8d. per yard. Small Electric Bells, 7s. 6d. each. Electric Call-Bell, with Key, Switch, and Battery complete, £3 the two sets; Magnetic ditto, £4 4s. Orders over 5s. post or carriage free; EDWARD PATERSON, Electric Bell Works, 3, Bedford Court, Covent Garden, W.C. Illustrated Catalogue for Two Stamps.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

J. I. HEADLY, ENGINEER, Cambridge, Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

S. A. SADLER,

CLEVELAND CHEMICAL WORKS,

MIDDLESBROUGH;

Newfall Tar Works, Carlton;

and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylols Solvent and Burning Naphthas, Carbolic Acid and Disinfectin' Powder, Refined Anthracene, Naphthaline, Black Varnish, Refine Tar, Crude Liquid Ammonia, Galvanising Salts, Coal-Tar, Pitch Creosote, Grease, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

MILTON CHEMICAL WORKS,

STOKE-ON-TRENT,

STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. heing a large manufacturer of the above can offer Special Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ar wick Chemica Works Manchester.

H. M. CAPNER,

Electrical and Philosophical Instrument Maker to the Trade only.

20, NORTHAMPTON SQUARE, LONDON E.C

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays.. ..	£2	2	0
200 Specimens, in Cabinet, with 5 Trays.. ..	5	5	0
300 Specimens, in Cabinet, with 9 Drawers ..	10	10	0
400 Specimens, in Cabinet, with 13 Drawers ..	21	0	0

More extensive Collections at 50 to 5000 Guineas each.

CÖTHEN.

F. Chemiker, Techniker, Fabrik., Ingenieure, Apotheker, Aerzte, Landwirthe. Chemisches Central-Annoncenblatt. Erscheint wöchentl. Durch j. Postanst. u. Buchhdl. zu bezichen. Preis viertelj. 2,50 M., durch Streifb. 3 M., nach dem Auslande 4,00 M. ANZEIGEN: 30 Pf. p. Zeile. Probenummern kostenfrei!

THE NEW MINIATURE SPRENGEL PUMP.

(STEARN AND SWAN'S PATENT.)

As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, Londo

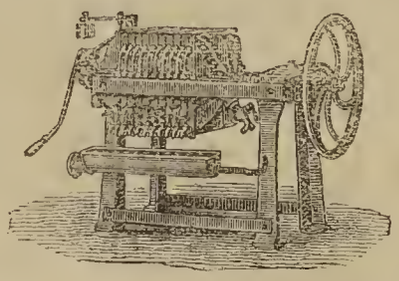
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

The speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING, and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE — Lump, Crystallised, Ground, and Prepared Large stock of every description. *** *Suitable for all Trades.*

ARSENIC — Refined powdered, Lump, Grey, and Ruby.

FLUOR-SPAR — Finest produced. Medium and Common for al purposes.

BARYTES — Carbonate and Sulphate. All qualities of Lump and Ground.

BAUXITE — Of high percentage of Alumina and low in Iron:

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

MINERALS, FOSSILS, AND ROCKS.

JAMES R. GREGORY'S
NEW AND EXTENSIVE SHOW-ROOMS,
88, Charlotte Street, Fitzroy Square, London, W.

COLLECTIONS especially prepared for teaching purposes, at all prices from half-a-guinea upwards. Also single specimens, Geological Hammers, Cabinets, Books, Glass-topped Boxes, &c.

Detailed Catalogues (74 pages) free for six stamps.

F. W. BERK & CO.,

18, CULLUM STREET, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

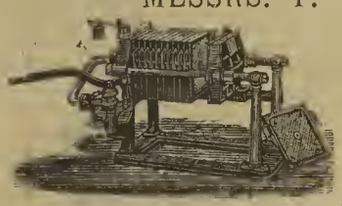
POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE
BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

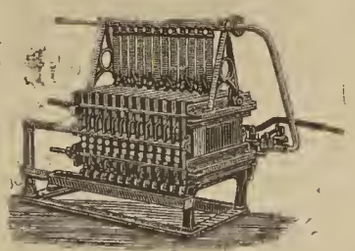
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 18, CULLUM STREET, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

TOWNSON & MERCER
(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
e Agents for Prof. Wanklyn's Test Solutions or Water Analysi

Illustrated Catalogue post ree on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM
FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA
FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

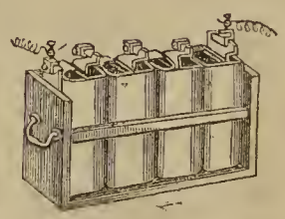
Manufactured by the
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.
Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

TAR DISTILLERS
BOUCK & Co LIMITED
DRYSALTERS
1862
LONDINI
HONORIS CAUSA
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp Zinc. Nitric Acids &c &c.
BRIMSTONE REFINERS
Samples & prices on application.
J. J. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE Oxalic Acid, Picric Acid, Sal-Acetosella BICHROME CHLORATE OF POTASH &c &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

CHEMICAL & SCIENTIFIC APPARATUS,

WHOLESALE AND RETAIL.

EVERY DESCRIPTION OF APPARATUS FOR STUDY, LECTURES, OR RESEARCH.



Country Orders, accompanied by a remittance, executed same day as received; and carriage paid in England and Wales if over £2 in value.

PRICE LISTS POST FREE ON APPLICATION.

M. JACKSON AND CO.,
65, BARBICAN, LONDON.

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,
(ESTABLISHED 1860.)

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

MANUFACTURERS OF

PURE CARBOLIC ACID, Cryst. at 42°·2 C. } Discovered by C. Lowe.
,, ,, do. Hydrate of
MEDICINAL do. Cryst. at 35° C.
COMMERCIAL do. No. 1 ,, 35° C.
,, do. 2 ,, 29° C.
,, do. 3 ,, 12° C.
,, do. 4 liquid at 0° C.
CARBOLIC ACID DISINFECTING POWDER.

CARBOLIC ACID GLYCERINE SOLUTIONS.
CRESYLIC ACID.
SULPHO-PHENIC ACID (CRYST.
SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.

BENZOL (Cryst.).
ANTHRACENE.
NAPHTHALINE.
PICRIC ACID (Cryst and Paste).
AURINE (Rosolic Acid Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,
OLDBURY, NEAR BIRMINGHAM.

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purpose Anthracene, Naphtnaline, Varnishes, Lubricating and Burning Oils, Grease. Pitch, Creosote, &c.

JOHN CLIFF,
STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
& IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY
RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate Hill E.C
February 15, 1878.

OF GREAT BRITAIN

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [*Established Twenty-six Years*

Vol. 37.—No. 952.] *Copyright reserved.* Friday, February 22, 1878. *Registered as a Newspaper.* [PRICE, 4*d*. POST FREE, 4½*d*

CONTENTS.

ARTICLES:— PAGE
On Dyer's Chemicals, by J. Marzell 75
Analysis of Cane-Sugar Ash, by Dr. Wallace 76
The Formation of Crystals of Calcium Oxalate in the Urine after its Discharge 76
The Application of Ammonium Sulphocyanide in Volumetric Analysis, by J. Volhard 77
PROCEEDINGS OF SOCIETIES:—
PHYSICAL SOCIETY.—On Grove's Gas Battery—Harmonograph—Lantern Slide Galvanometer 79
CORRESPONDENCE.—Ammonia in Filter Water—Estimation of Phosphorus in Iron and Steel—Institute of Chemistry—Copper Extraction—On the Motions of Camphor, &c. 79
CHEMICAL NOTICES FROM FOREIGN SOURCES 81
NOTES AND QUERIES.—Replacing Acids 84
MEETINGS FOR THE WEEK 84

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,
BEDMINSTER SMELTING WORKS, BRISTOL.

WILLIAM AND WILLIAM T. FIELD,
MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.
TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

SYSTEMATIC INVESTMENT IN PATENTS.

THE COMMERCIAL DEVELOPMENT OF PATENTED AND UNPATENTED INVENTIONS.

INVESTORS and INVENTORS are invited to apply for the Prospectus and Circular of the INVENTORS' AND GENERAL AGENCY, Limited, 76, Chancery Lane, London, W.C.
ANDREW GLENDINNING, Secretary.

Traveller, with good connection amongst Paper Makers, Wholesale and Retail Chemists and Druggists, is open to an Engagement to Represent a First Class House on salary and expenses.—H. J. Hudd, 6, Claremont Villas, Pelham Road, New Wimbledon.

CHEMICAL MANURES.

A London Waterside Factory in going order To Let.—N. F., Nissen and Arnold, 43, Mark Lane, E.C.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street, Glasgow.

NOW READY,
GRIFFIN'S CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

Just published, price One Shilling,
TELEPHONES, OLD AND NEW.
A Lecture by Professor BARRETT, M.R.I.A.
With Notes and Illustrations.
London: HORATIO YEATES, Optical and Philosophical Instrument Maker, 33, King Street, Covent Garden.

WATER ANALYSIS.—Prof. WANKLYN, Lecturer on Chemistry and Physics at St. George's Hospital, Public Analyst for Buckinghamshire, Buckingham, High Wycombe Peterborough, and Shrewsbury, has REMOVED to 7 Westminster Chambers, Victoria Street, S.W

MACTEAR'S PATENT CARBONATING FURNACE,
AND
JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,
MANUFACTURED BY
R. DAGLISH & CO.,
ST. HELEN'S ENGINE AND BOILER WORKS,
LANCASHIRE.
Prices and other particulars on application.

A Gentleman desires an Appointment as Analyst in a Chemical Laboratory or Works. Has had some experience in teaching, and holds high class testimonials. No objection to go abroad.—Address, N. R. E., F.C.S., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

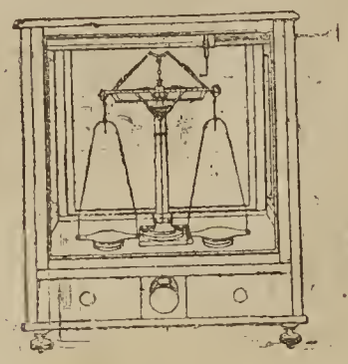
A Gentleman of considerable experience in analytical and manufacturing chemistry wishes to Purchase a Half or Third Share in a Commercial Laboratory or Chemical Works. —Address, C. C., St. Bartholomew's Hospital, London.

CHEMICALS, &c.

A Gentleman, occupying suitable offices within five minutes' walk of the Bank, is open to take up one or two good Agencies. Manufacturers only will be treated with. Satisfactory references given and required.—Apply, by letter only, P. 433, London Institution, Finsbury Circus, E.C.

Wanted, by a Young Man, a Situation. Is a good Chemist, having studied under an eminent Professor of Chemistry, also thoroughly understands book-keeping. Nine years in last situation. Highest testimonials and references. No objection to go abroad.—Address, Beta, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

For Disposal.—CHEMICAL NEWS, Back Volumes, Nos. I. to VIII., bound in Chemical News cloth cases; good condition. Also Rose's "Chemistry," 3 volumes, nearly new.—Address offers to F. M. Chadwick, King Street, Tunstall, Staffordshire.



L. OERTLING,

TURNMILL STREET

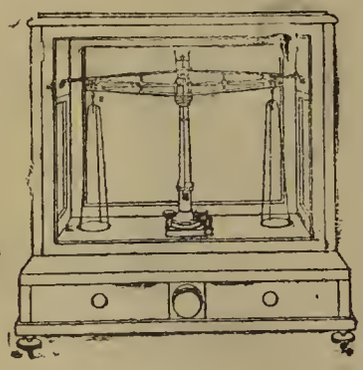
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

SIXTH EDITION. ILLUSTRATED.

ATTFIELD'S CHEMISTRY,

8vo., Price 15s.

GENERAL, MEDICAL, AND PHARMACEUTICAL

"We heartily recommend this work to the pharmacist and physician."—*American Journal of Pharmacy.*

"For all the numerous class of students who are preparing for the medical or for the pharmaceutical profession, we know of no work in the language which can be compared with the one before us."—*Chemical News*, November, 1875.

JOHN VAN VOORST, 1, PATERNOSTER ROW.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Salt Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA.

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS, LIQUOR AMMONIA, &c.

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

BISULPHITE OF LIME.

BISULPHITE OF SODA.

WILLIAM MARRIOTT

CHEMICAL WORKS HUDDERSFIELD

JAMES WOOLLEY, SONS, & CO.

69, MARKET STREET, MANCHESTER,

DEALERS IN

CHEMICAL AND SCIENTIFIC APPARATUS CHEMICAL REAGENTS, &c.,

FOR THE USE OF

ANALYSTS, SCIENCE TEACHERS, AND MANUFACTURERS

Price Lists on application.

DO YOUR OWN PRINTING.

The "Optimus" Printing-Press for Amateurs.

Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A HERBERT, Printing Warehouse, 50, Finsbury Square, London, E.C

A. BOAKE & CO.,

STRATFORD, LONDON, E.,

MAKERS OF

THE SULPHITES AND BISULPHITES

OF

SODA AND LIME.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene ,Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Galvanising Salts, Coal-Tar, Pitch Creosote, Grease, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracen and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

MILTON CHEMICAL WORKS,
STOKE-ON-TRENT,
STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Special Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ar wick Chemica Works Manchester.

H. M. CAPNER,
Electrical and Philosophical Instrument Maker to the Trade only.

20, NORTHAMPTON SQUARE, LONDON E.C

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays.. ..	£2	2 0
200 Specimens, in Cabinet, with 5 Trays.. ..	5	5 0
300 Specimens, in Cabinet, with 9 Drawers ..	10	10 0
400 Specimens, in Cabinet, with 13 Drawers ..	21	0 0

More extensive Collections at 50 to 5000 Guineas each.

CÖTHEN.

F. Chemiker, Techniker, Fabrik., Ingenieure, Apotheker, Aerzte, Landwirthe. Chemisches Central-Annoncenblatt. Erscheint wöchentl. Durch j. Postanst. u. Buchhdl. zu beziehen. Preis viertelj. 2,50 M., durch Streifb. 3 M., nach dem Auslande 4,00 M. ANZEIGEN: 30 Pf. p. Zeile. Probenummern kostenfrei!

THE NEW MINIATURE SPRENGEL PUMP.
(STEARN AND SWAN'S PATENT.)

As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

BISULPHIDE OF CARBON,
PROTOSULPHATE,
RED OXIDE
OXYCHLORIDE
Sulphocyanide,
And every other Mercurial Preparation.

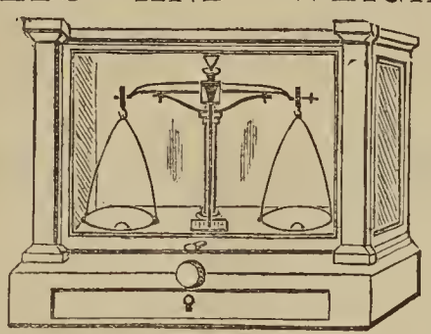
BISULPHITE OF LIME, TETRACHLORIDE OF CARBON
Oxysulphuret of Antimony, Glacial Acetic Acid,

LIQUOR AMMONIÆ,
SULPHIDE OF IRON,
PURE ACIDS,
CHLORIDE OF SULPHUR,
ACETONE,
CHLOROFORM,
ALDEHYDE,
CHLORATE BARYTA,
ARSENIC ACIDS,
FRUIT ESSENCES FOR CONFECTIONERY & LIQUEURS,
PERCHLORIDE OF IRON,
SULPHITE AND HYPOSULPHITE OF SODA,
PHOSPHATES OF SODA AND AMMONIA,
ETHERS,
BROMIDES,
IODIDES,
SCALE AND GRANULAR PREPARATIONS.

ALSO,
Pure Photographic Chemicals of every kind.
MANUFACTURED BY
WILLIAM BAILEY & SON,
HORSELEY FIELDS CHEMICAL WORKS,
WOLVERHAMPTON

BECKER & SONS,
MANUFACTURERS OF
CHEMICAL AND GOLD ASSAY BALANCES
AND OTHER
SCALES AND WEIGHTS.

ROTTERDAM.



NEW YORK.

BECKER'S STUDENT'S BALANCE, in polished mahogany glass case, sliding front, counterpoised, to carry 30 grammes in each pan and turn to ½ milligramme, nickel plated pans..£2 10
Ditto, ditto, in mahogany glass case, polished black £2 13

Sole Agents for England, Ireland, and Wales:—
TOWNSON & MERCER,

Becker's Complete Lists forwarded by post on receipt of 1*d.* stamp, or free on application.

CHEMISTS AND MANUFACTURERS
Are solicited, before purchasing FILTER-PRESSES, to examine the merits of
JOHNSON'S PATENT HYDRAULIC FILTER,
And judge from a trial whether it is not by far the BEST, CHEAPEST, and MOST RAPID means of Filtration in the Market, for,—
SEPARATING SOLIDS FROM SEMI-FLUIDS,
FILTERING LIQUIDS BRIGHT,
WASHING PRECIPITATES,
DRYING PRECIPITATES SLURRY OR SLUDGE.

WORKS—CARPENTER'S ROAD, STRATFORD.
LONDON OFFICES—N. NUTTER, 71, CORNHILL, E.C

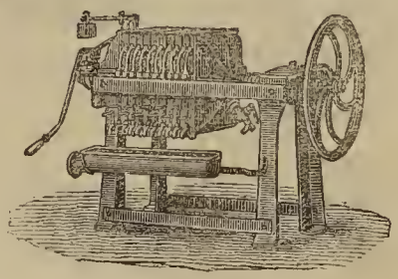
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

The speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction to Suit Special Requirements.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE Lump, Crystallised, Ground, and Prepared Large stock of every description.
*** *Suitable for all Trades.*

ARSENIC Refined powdered, Lump, Grey, and Ruby.

FLUOR-SPAR Finest produced. Medium and Common for a purposes.

BARYTES Carbonate and Sulphate. All qualities of Lump and Ground.

BAUXITE Of high percentage of Alumina and low in Iron.

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—Special attention is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

MINERALS, FOSSILS, AND ROCKS.

JAMES R. GREGORY'S
NEW AND EXTENSIVE SHOW-ROOMS,
88, Charlotte Street, Fitzroy Square, London, W.

COLLECTIONS especially prepared for teaching purposes, at all prices from half-a-guinea upwards. Also single specimens, Geological Hammers, Cabinets, Books, Glass-topped Boxes, &c.

Detailed Catalogues (74 pages) free for six stamps.

F. W. BERK & CO.,

18, CULLUM STREET, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

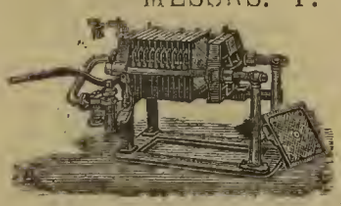
POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE, BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

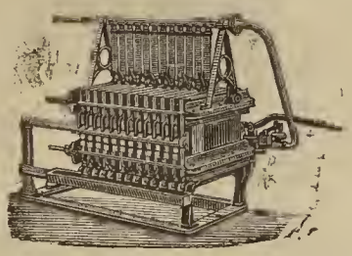
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 18, CULLUM STREET, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

heques and Post-Office Orders, crossed "London and County k," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

TOWNSON & MERCER
(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
e Agents for Prof. Wanklyn's Test Solutions or Water Analysi

Illustrated Catalogue post ree on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

Manufactured by the
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.
Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

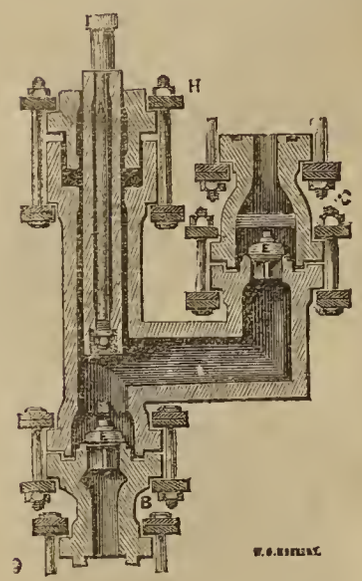
TAR DISTILLERS
DRYSALTERS
BOUCK & Co
LIMITED
MILES PLATING
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp Zinc Nitric Acids &c &c.
BRIMSTONE REFINERS Samples & prices on application. J.I. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID, PICRIC ACID, Sal-Acetosella BICHROME CHLORATE OF POTASH, &c &c. BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

DOULTON & WATTS

HIGH STREET, LAMBETH, LONDON, S.E.

MANUFACTURERS OF

STONEWARE ACID PUMPS AND COCKS,

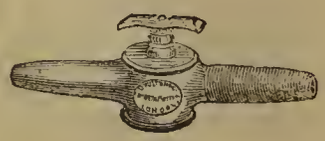


STILLS, RETORTS, CONDENSING WORMS

WOLFF'S BOTTLES

PERCOLATORS, AIR-TIGHT JARS,

And every description of Stoneware or Chemical Purposes, warranted to resist the strongest acids.



PLUMBAGO CRUCIBLES AND OTHER FIRE-STANDING GOODS.

CHEMISTS' & DRUGGISTS' GLASS. PORCELAIN TAPS

Price Lists of any of the above, and of every description of Stoneware, may be had on application.

Messrs. D. and W. were awarded a **MEDAL** for **ACID PUMPS**, and also one for **PLUMBAGO CRUCIBLES**, at the Vienna Exhibition, 1873.

Head Offices and Show Rooms, HIGH STREET, LAMBETH, S.E.

Depots:—Granville Wharf, Wood Street, Birmingham; 100, Soho Street, Liverpool; Hope Street, Salford Manchester; and 6, Rue de Paradis Poissonière, Paris.

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

MANUFACTURERS OF

URE CARBOLIC ACID, Cryst. at 42°·2 C.	Discovered by C. Lowe.	CARBOLIC ACID GLYCERINE SOLUTIONS.	BENZOL (Cryst.).
,, ,, do. Hydrate of		CRESYLIC ACID.	ANTHRACENE.
MEDICINAL do. Cryst. at 35° C.		SULPHO-PHENIC ACID (CRYST.	NAPHTHALINE.
COMMERCIAL do. No. 1 ,, 35° C.		SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.	PICRIC ACID (Cryst and Paste).
,, do. 2 ,, 29° C.			AURINE (Rosolic Acid Cake and Solution.
,, do. 3 ,, 12° C.			
,, do. 4 liquid at 0° C.			
CARBOLIC ACID DISINFECTING POWDER.			

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesal and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,

OLDBURY, NEAR BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purpose Anthracene, Naphthaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF, STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
& IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate Hill E.C February 22, 1878.

PHARMACEUTICAL SOCIETY OF GREAT BRITAIN

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [*Established Twenty-six Years.*

Vol. 37.—No. 953.] *Copyright reserved.* Friday, March 1, 1878. *Registered as a Newspaper.* [PRICE, 4*d*. POST FREE, 4½*d*

CONTENTS.

ARTICLES:— PAGE
The Action of Sodium on Chinoline and Lepidine, by C. Greville Williams, F.R.S. 85
On Dyer's Chemicals, by J. Marzell 85
Application of Organic Acids to the Examination of Minerals, by H. Carrington Bolton, Ph.D. 86
PROCEEDINGS OF SOCIETIES:—
CHEMICAL SOCIETY.—Laboratory Experiences on Board the Challenger 87
EDINBURGH UNIVERSITY CHEMICAL SOCIETY 89
PHILOSOPHICAL SOCIETY OF GLASGOW.—Bishop's Improved Process of Regenerating the Lime used in the Purification of Coal-gas 89
CORRESPONDENCE.—Institute of Chemistry—Ammonia in Filtered Water 92
CHEMICAL NOTICES FROM FOREIGN SOURCES 93

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

SYSTEMATIC INVESTMENT IN PATENTS.

THE COMMERCIAL DEVELOPMENT OF PATENTED AND UNPATENTED INVENTIONS.

INVESTORS and INVENTORS are invited to apply for the Prospectus and Circular of the INVENTORS' AND GENERAL AGENCY, Limited, 76, Chancery Lane, London, W.C.

ANDREW GLENDINNING, Secretary.

FOR SALE.

Oak Lead-lined Vat, holding 600 gallons, with spiral steam coil on supports; all joints burnt.—Apply to J. Schwartz, Sugar Refinery, Pelham Street, E.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street, Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

MACTEAR'S PATENT CARBONATING FURNACE,
AND
JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,
MANUFACTURED BY
R. DAGLISH & CO.,
ST. HELEN'S ENGINE AND BOILER WORKS,
LANCASHIRE.
Prices and other particulars on application.

A Gentleman desires an Appointment as Analyst in a Chemical Laboratory or Works. Has had some experience in teaching, and holds high class testimonials. No objection to go abroad.—Address, N. R. E., F.C.S., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

A Gentleman of considerable experience in analytical and manufacturing chemistry wishes to Purchase a Half or Third Share in a Commercial Laboratory or Chemical Works. —Address, C. C., St. Bartholomew's Hospital, London.

A Young German Chemist (Ph.D., Leipzig) seeks an Engagement in a Chemical Manufactory.—Address, R. J., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Partner required, with from £10,000 to £20,000, by the Proprietor of one of the oldest established Chemical Manufactories in the North of England.—Address, Chemicus, care of J. M. Quiggin, Solicitor, Brunswick Street, Liverpool.

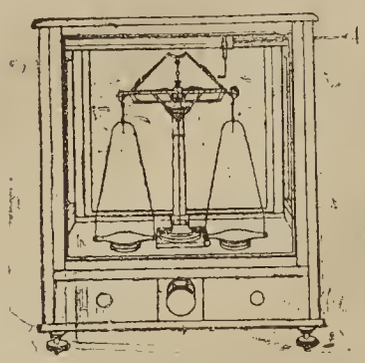
Wanted, a First Class Man for Sulphate of ammonia in some Works near London.—Address, X., at Horncastle's Central Advertisement Offices, 61, Cheapside, E.C.

Wanted, a Situation as Mechanical Engineer and Plumber in Chemical Works; Continent not objected to. —Address, W. J., 30, Mostyn Road, North Bow.

FOR SALE BY PRIVATE CONTRACT.

Two Revolving Ball Furnaces, 15·6 long by 9 ft. diam.; Shell of ⅝ Boiler-plate bound by metal rings and malleable iron tyres, carrying wheels of metal with iron tyres; Solid Scroll Wheel on Shell for driving, also gearing for quick and slow speeds, &c.—May be seen at work and further particulars obtained on application to the Jarrow Chemical Co., South Shields.

Wanted, by a Young Man, a Situation. Is a good Chemist, having studied under an eminent Professor of Chemistry, also thoroughly understands book-keeping. Nine years in last situation. Highest testimonials and references. No objection to go abroad.—Address, Beta, CHEMICAL NEWS Office, Boy Court Ludgate Hill, London, E.C.



L. OERTLING,

TURNMILL STREET

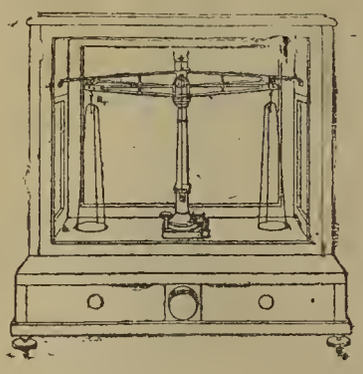
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA.

DO YOUR OWN PRINTING.

The "Optimus" Printing-Press for Amateurs. Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A HERBERT, Printing Warehouse, 50, Finsbury Square, London, E.C

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS, LIQUOR AMMONIA, &c.

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

BISULPHITE OF LIME.

BISULPHITE OF SODA.

WILLIAM MARRIOTT

CHEMICAL WORKS HUDDERSFIELD

F. Chemiker, Techniker, Fabrik., Ingenieure, Apotheker, Aerzte, Landwirthe. Chemisches Central-Annoncenblatt. Erscheint wöchentl. Durch j. Postanst. u. Buchhdl. zu beziehen. Preis viertelj. 2,50 M., durch Streifb. 3 M., nach dem Auslande 4,00 M. ANZEIGEN: 30 Pf. p. Zeile. Probenummern kostenfrei!

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

---

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays.. ..	£2	2 0
200 Specimens, in Cabinet, with 5 Trays.. ..	5	5 0
300 Specimens, in Cabinet, with 9 Drawers ..	10	10 0
400 Specimens, in Cabinet, with 13 Drawers ..	21	0 0

More extensive Collections at 50 to 5000 Guineas each.

SCIENTIFIC AND INDUSTRIAL WORKS.

ARNOTT'S ELEMENTS of PHYSICS or NATURAL PHILOSOPHY. Re-edited by A. BAIN, LL.D., and A. S. TAYLOR, M.D. Crown 8vo. Woodcuts, 12s. 6d.

GANOT'S ELEMENTARY TREATISE on PHYSICS, Experimental and Applied. Translated by E. ATKINSON, Ph.D., F.C.S. With 4 Plates and 758 Woodcuts. Post 8vo., 15s.

GANOT'S NATURAL PHILOSOPHY for GENERAL READERS and YOUNG PERSONS. Translated by E. ATKINSON, Ph.D., F.C.S. With 2 Plates and 429 Woodcuts. Crown 8vo., 7s. 6d.

A DICTIONARY of CHEMISTRY and the Allied Branches of Other Sciences. By HENRY WATTS, F.R.S., assisted by eminent Contributors. 7 vols., 8vo., £10 16s. 6d.

MILLER'S INORGANIC CHEMISTRY (TEXT-BOOKS of SCIENCE). With 71 Woodcuts. Small 8vo., 3s. 6d.

Dr. ODLING'S COURSE of PRACTICAL CHEMISTRY, for Medical Students, with express reference to the Three Months' Summer Practice. With 71 Woodcuts. Crown 8vo., 6s.

HELMHOLTZ on the SENSATIONS of TONE, as a Physiological Basis for the Theory of Music. Translated by A. J. ELLIS, F.R.S. 8vo., 36s.

HELMHOLTZ'S POPULAR LECTURES on SCIENTIFIC SUBJECTS. Translated by E. ATKINSON, Ph.D., F.C.S. 8vo. Woodcuts, price 12s. 6d.

OUTLINES of ASTRONOMY. By Sir J. F. W. HERSCHEL, Bart., M.A. Latest Edition, with Plates and Diagrams. Square crown 8vo., 12s.

DECAISNE'S GENERAL SYSTEM of BOTANY, DESCRIPTIVE and ANALYTICAL. Translated by Mrs. HOOKER. With 5,500 Woodcuts. Imperial 8vo., 31s. 6d.

The GEOLOGY of ENGLAND and WALES. By H. B. WOODWARD, F.G.S. With a Coloured Map and 29 Woodcuts. Crown 8vo., 14s.

BRANDE'S DICTIONARY of SCIENCE, LITERATURE, and ART. Re-edited by the Rev. Sir G. W. COX, Bart., M.A., Revised Edition. 3 vols., 8vo., 63s.

URE'S DICTIONARY of ARTS, MANUFACTURES, and MINES. Seventh Edition, re-edited by R. HUNT, F.R.S. With 2100 Woodcuts. 3 vols., 8vo., £5 5s.

The ART of ELECTRO-METALLURGY, including all known Processes of Electro-Deposition. By G. GORE, LL.D., F.R.S. With 56 Woodcuts. Small 8vo., 6s.

KERL'S PRACTICAL TREATISE on METALLURGY, adapted from the last German Edition by W. CROOKES, F.R.S., and E. RÖHRIG, Ph.D. With 625 Woodcuts. 3 vols, 8vo., £4 19s.

A TREATISE on the STEAM ENGINE, in its Applications to Mines, Mills, Steam Navigation, Railways, and Agriculture. By J. BOURNE, C.E. With Portrait, 37 Plates, and 546 Woodcuts. 4to., 42s.

BOURNE'S CATECHISM of the STEAM ENGINE, in its various Applications. With 89 Woodcuts. Fcp. 8vo., 6s.

BOURNE'S HANDBOOK of the STEAM ENGINE, a KEY to the Catechism of the Steam Engine, with 67 Woodcuts. Fcp. 8vo., 9s.

BOURNE'S RECENT IMPROVEMENTS in the STEAM ENGINE, in its various Applications. With 124 Woodcuts. Fcp. 8vo., 6s.

GWILT'S ENCYCLOPÆDIA of ARCHITECTURE, with above 1600 Woodcuts. Revised and extended by W. PAPWORTH. 8vo., 52s. 6d.

CROOKES'S PRACTICAL HANDBOOK of DYEING and CALICO PRINTING. With 11 Plates, 49 Specimens of Dyed and Printed Fabrics, and 36 Woodcuts. 8vo., 42s.

KINGZETT on the PRODUCTS and PROCESSES of the ALKALI TRADE, including the most Recent Improvements. With 23 Woodcuts. 8vo., 12s.

MITCHELL'S MANUAL of PRACTICAL ASSAYING. Re-written, with all the recent Discoveries incorporated, by W. CROOKES, F.R.S. With 199 Woodcuts. 8vo., 31s. 6d.

The ENGINEERS' VALUING ASSISTANT. By H. D. HOSKOLD, Civil and Mining Engineer, 16 years Mining Engineer to the Dean Forest Iron Company. 8vo., 31s. 6d., half-bound.

London: LONGMANS and CO.

TEXT-BOOKS OF SCIENCE.

In small 8vo., with 72 Diagrams and Figures, price 3s. 6d.

INORGANIC CHEMISTRY (Introduction to the Study of). By W. ALLEN MILLER, M.D., late Prof. of Chem King's Coll., London. New Edition, with Questions for Examination

London: LONGMANS and CO.

Mr. WATTS'S DICTIONARY OF CHEMISTRY.

Complete in 7 vols., medium 8vo., price £10 16s. 6d.

A DICTIONARY of CHEMISTRY, and the Allied Branches of other Sciences. By HENRY WATTS, F.R.S., assisted by eminent Scientific and Practical Chemists.

"The greatest work which England has yet produced on chemistry—one of the greatest, indeed, which she has produced upon any scientific subject—is finished at last, and we are able to congratulate Mr. Watts most sincerely upon its completion."—*Chemical News.*

"The English language is not rich in lexicons of science: we would point to this work as a model upon which others might be framed. It certainly exhausts the subject up to the date of publication, and therefore forms as it were the balanced ledger of the chemist."—*Athenæum.*

London: LONGMANS and CO.

Just published, price 2s. 6d.

THE LONDON WATER SUPPLY. By CHARLES MEYMOTT TIDY, M.B., Professor of Chemistry at the London Hospital.

London: J. and A. CHURCHILL.

CHEMICAL LABORATORY, WIESBADEN, GERMANY.

Director—Prof. R. FRESENIUS, Ph.D

LECTURES.

Experimental Chemistry (Inorganic)	Prof. R. FRESENIUS, Ph.D.
Experimental Physics, Organic Chemistry, Theoretical Chemistry	Prof. C. NEUBAUER, Ph.D.
Chemical Technology	H. FRESENIUS, Ph.D.
Botany, Zoology	Prof. L. KIRSCHBAUM, Ph.D.
Mineralogy	C. KOCH, Ph.D., State Geologist.
Microscopy, with exercises in microscopic work	H. THILENIUS, M.D.
Practical Instruction in the Laboratory	Prof. R. FRESENIUS, Ph.D., H. FRESENIUS, Ph.D., and two Assistants.

The next Session commences on the 24th of April. The Regulations of the Laboratory and the Syllabus of Lectures will be forwarded gratis on application to C. W. KREIDEL'S Verlag, at Wiesbaden, or to the undersigned.

Prof. R. FRESENIUS, Ph.D.

FILTER-PRESSES.

JOHN BEVERLEY and SON, ST. COLUMBA WORKS, WOODHOUSE LANE, LEEDS,

Manufacture FILTER-PRESSES which for Price and Workmanship compare favourably with those of other English and Foreign makers.—Prices, &c., on application.

DIAPHRAGM PUMPS, STEAM-ENGINES, AIR-COMPRESSORS, MONTS DE JUS, &c.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

J. I. HEADLY, ENGINEER, Cambridge, Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

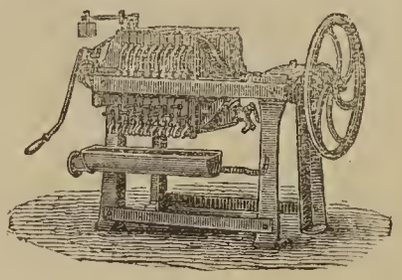
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

The speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction to Suit Special Requirements.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE — Lump, Crystallised, Ground, and Prepared Large stock of every description. *** *Suitable for all Trades.*

ARSENIC — Refined powdered, Lump, Grey, and Ruby.

FLUOR-SPAR — Finest produced. Medium and Common for a purposes.

BARYTES — Carbonate and Sulphate. All qualities of Lump and Ground.

BAUXITE — Of high percentage of Alumina and low in Iron:

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,
MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—Special attention is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

H. M. CAPNER,

Electrical and Philosophical Instrument Maker to the Trade only.

20, NORTHAMPTON SQUARE, LONDON E.C

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ar wick Chemica Works Manchester.

F. W. BERK & CO.,

18, CULLUM STREET, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.

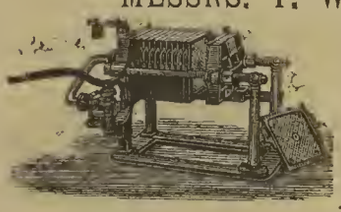
SULPHATE OF AMMONIA, ANTHRACENE, BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

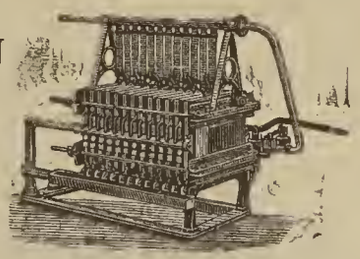
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

THE CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	a.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

heques and Post-Office Orders, crossed "London and County k," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),

Wholesale and Export Dealers and Manufacturers of

CHEMICAL & SCIENTIFIC APPARATUS

Graduated Instruments, Pure Chemicals, &c.,

Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,

89, Bishopsgate Street Within,
LONDON.

e Agents for Prof. Wanklyn's Test Solutions or Water Analysi

Illustrated Catalogue post ree on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

FOR DYEING AND CALICO PRINTING.

VANADIUM.

OXIDE AND SULPHIDES OF VANADIUM
FOR ANILINE BLACK.

CHLORIDE OF VANADIUM AND VANADIATE AMMONIA
FOR CATECHU BROWN.

CHLORATE OF SODA.

IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

Manufactured by the

MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.

Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

TAR DISTILLERS

BOUCK & Co LIMITED

MILES PLATTING, MANCHESTER

DRYSALTERS

MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp Zinc Nitric Acids &c &c.

BRIMSTONE REFINERS Samples & prices on application. J.I. VAUGHAN Secretary

AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID. PICRIC ACID, Sal-Acetosell BICHROME CHLORATE OF POTASH, &c. &c. BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

CALVERT'S CARBOLIC ACID.

HIGHEST PRIZE MEDAL AT PARIS EXHIBITION, 1867.

GOLD AND SILVER MEDALS, HAVRE, 1868. DIPLOME D'EXCELLENCE, AMSTERDAM SILVER MEDAL, FIRST CLASS, NAPLES, 1871. GOLD MEDAL, MOSCOW, 1872.

F. C. CALVERT & CO., of Bradford, Manchester (original and only Manufacturers of pure Medical Carbolic Acid), beg to inform the Trade and large Consumers that their pure Medical Carbolic as well as cheaper qualities for Commercial, Veterinary, and Disinfecting Purposes, also Carbolic Acid Soaps for Medical, Toilet, and General Use, Soft Soap o Dogs, and Carbolic Acid Disinfecting Powder, may be had from any of the below-named Wholesale Agents—

Apothecaries' Soc., Lond'n
Apothecaries' Co., Glasg'w
Apothecaries'Hall, Dublin
Allen & Hanburys
J. Bell & Co.
Barron, Harveys, & Co.
Barclay & Sons.
Burgoyne & Co.
Baiss Brothers & Co.
Barron, Squire, & Co.
Battley & Watts
Bewley & Draper
H. B. Brady
Bainbridge & Pound
Aoileau & Boyd
urling & Co.
Corbyn & Co.
C

Clarke, Bleasdale, & Co.
Clay, Dod, & Case
Dakin Brothers
Davy, Yates, & Co.
Duncan, Flockhart, & Co.
W. Edwards & Son
Evans, Lescher, & Evans
Evans, Sons, & Co.
Evans, Gadd, & Co.
Ferris & Co.
Glasgow New Apoth. Co.
General Apothecaries' Co.
W. & H. M. Goulding
Goodall, Backhouse, & Co.
Grimwade, Ridley, & Co.
Hodgkinsons, Stead, & Co.
Herrings & Co.

Hodgkinsons, Preston, & King
Hearon, Squire, & Francis
Hopkin & Williams
Howards & Sons
Hirst, Brooke, & Co.
W. R. Hatrick & Co.
P. Harris & Co.
Hunt & Co.
J. Ismay
Johnson & Sons
Langtons, Edden, & Hicks
Lynch & Co.
Lofthouse & Saltmer
Chas. Leslie
Maw, Son, & Thompson
H. C. Mason

W. Mather
McMaster, Hodgson, & Co.
J. F. Macfarlan & Co.
J. Mackay
R. H. Millard & Son
Mackey, Sellers, & Co.
Mottershead & Co.
Newbery & Sons
Paterson & Son
Raimes & Co.
J. Richardson & Co.
Raimes, Blanshards, & Co.
J. Reddish & Co.
Sanger & Sons
Savory & Moore.
W. Sutton & Co.
R. Sumner & Co.

James Sim & Co,
Sang & Barker
Southall, Bros., & Co.
W. Smeeton
Slinger & Barnett
P. Sandeman & Co.
Tidman & Son
Taylor, Gibson, & Co.
Thacker & Hoffe
Jas. Taylor
J. Woolley, Sons, & Co
Wyleys & Co.
Wilson & Kitchen
C. H. Warner & Co.
A. & J. Warren
Walkington & Son
Wright, Layman, & Unn

S. A. SADLER,

CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Galvanising Salts, Coal-Tar, Pitch Creosote, Grease, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracen and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

MILTON CHEMICAL WORKS,
STOKE-ON-TRENT,
STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish. Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

FACTORIES:
Reddish and Bradford,
MANCHESTER.

CHARLES LOWE & CO.,
(Established 1860.)

TOWN OFFICES:
61, Piccadilly,
MANCHESTER.

MANUFACTURERS OF

U RE Carbolic Acid, Cryst. at 42°·2 C.	Discovered by C. Lowe.	Carbolic Acid Glycerine Solutions.
,, ,, do. Hydrate of		Cresylic Acid.
Medicinal do. Cryst. at 35° C.		Sulpho-Phenic Acid (Cryst.
Commercial do. No. 1 ,, 35° C.		Sulpho-Phenates & Sulpho-Cresylates of Soda, Potash, Zinc, Iron, and Alumina.
,, do. 2 ,, 29° C.		
,, do. 3 ,, 12° C.		
,, do. 4 liquid at 0° C.		
Carbolic Acid Disinfecting Powder.		

Benzol (Cryst.).
Anthracene.
Naphthaline.
Picric Acid (Cryst and Paste).
Aurine (Rosolic Acid Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesal and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,
OLDBURY, near BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purpose Anthracene, Naphthaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF,
STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY
RUNCORN.

London: Printed and Published for the Proprietor by Edwin John Davey, at the Office, Boy Court, Ludgate Hill E.C
March 1, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [Established Twenty-six Years.

Vol. 37.—No. 954.] Copyright reserved. Friday, March 8, 1878. Registered as a Newspaper. [PRICE, 4d. POST FREE, 4½d

CONTENTS.

ARTICLES:— PAGE
New Products Obtained from Coal-gas: Ponscelion, a New Pigment, and Cyanon, a New Gunpowder, by Lewis Thompson .. 95
On Some Thallium Pigments, by Thomas W. Salter, F.C.S..... 96
On the Solution of Molybdate of Ammonia in Nitric Acid, by Sergius Kern, M.E..... 97
Coloured Crystalline Compounds Obtained from Brucine, by David Lindo 97
Application of Organic Acids to the Examination of Minerals, by H. Carrington Bolton, Ph.D..... 98
PROCEEDINGS OF SOCIETIES:—
PHYSICAL SOCIETY 99
EDINBURGH UNIVERSITY CHEMICAL SOCIETY 100
NOTICES OF BOOKS.—The London Water Supply 100
CORRESPONDENCE 101
CHEMICAL NOTICES FROM FOREIGN SOURCES..... 102

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

FOR SALE.

Oak Lead-lined Vat, holding 600 gallons, with spiral steam coil on supports; all joints burnt.—Apply to J. Schwartz, Sugar Refinery, Pelham Street, E.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing rare Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for Students, Schools, Colleges, &c.

NEW PATTERNS OF GEOLOGICAL HAMMERS.
NEW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
88, CHARLOTTE STREET, FITZROY SQUARE.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

Sixth Edition Illustrated.
Post 8vo., Price 15s.

ATTFIELD'S CHEMISTRY,
GENERAL, MEDICAL, AND PHARMACEUTICAL.

"For all the numerous class of students who are preparing for the medical or for the pharmaceutical profession, we know of no work in the language which can be compared with the one before us."—*Chemical News.*

"Written with a just appreciation of the small amount of time for the study of chemistry at the disposal of the student in medicine and pharmacy.—*Nature.*

JOHN VAN VOORST, 1, PATERNOSTER ROW.
The Seventh Edition, specially arranged for American Students, is published by Lea, Philadelphia.

MACTEAR'S PATENT CARBONATING FURNACE,
AND
JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,
MANUFACTURED BY
R. DAGLISH & CO.,
ST. HELEN'S ENGINE AND BOILER WORKS,
LANCASHIRE.
Prices and other particulars on application.

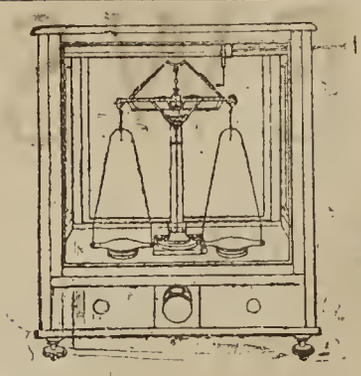
A Chemist and Metallurgist, Analyst and Assayer, with practical experience in treatment of Copper Ores, &c., by wet process, lead refining, and manufacture of white lead, and some experience in oil refining, and many other works and processes, desires an engagement as Chemist, manager or otherwise, or, having some connection, would join another in practice.—Address, F.C S., Alexander's, 24, Old Cavendish Street, W.

A Gentleman desires an Appointment as Analyst in a Chemical Laboratory or Works. Has had some experience in teaching, and holds high class testimonials. No objection to go abroad.—Address, N. R. E., F.C.S., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

A Young German Chemist (Ph.D., Leipzig) seeks an Engagement in a Chemical Manufactory.—Address, R. J., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

FOR SALE BY PRIVATE CONTRACT

Two Revolving Ball Furnaces, 15·6 long by 9 ft. diam.; Shell of ⅜ Boiler-plate bound by metal rings and malleable iron tyres, carrying wheels of metal with iron tyres; Solid Scroll Wheel on Shell for driving, also gearing for quick and slow speeds, &c.—May be seen at work and further particulars obtained on application to the Jarrow Chemical Co., South Shields.



L. OERTLING,

TURNMILL STREET

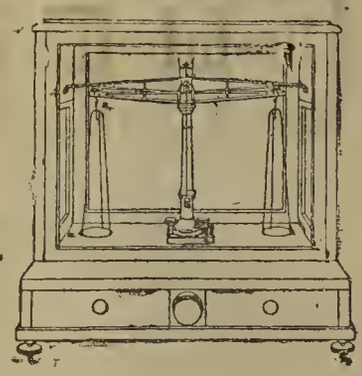
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA.

DO YOUR OWN PRINTING.

The "Optimus" Printing-Press for Amateurs. Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A HERBERT, Printing Warehouse, 50, Finsbury Square, London, E.C

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS, LIQUOR AMMONIA, &c.

Silicates of Soda and Potash in the state o Soluble glass, or in CONCENTRATED SOLUTION of firs quality, suited for the manufacture of Soap and other purposes supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

BISULPHITE OF LIME.

BISULPHITE OF SODA.

WILLIAM MARRIOTT

CHEMICAL WORKS HUDDERSFIELD

F. Chemiker, Techniker, Fabrik., Ingenieure, Apotheker, Aerzte, Landwirthe. Chemisches Central-Annoncenblatt. Erscheint wöchentl. Durch j. Postanst. u. Buchhdl. zu beziehen. Preis viertelj. 2,50 M., durch Streifb. 3 M., nach dem Auslande 4,00 M. ANZEIGEN: 30 Pf. p. Zeile. Probenummern kostenfrei!

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

A. BOAKE & CO.,

STRATFORD, LONDON, E.,

MAKERS OF

THE SULPHITES AND BISULPHITES

OF

SODA AND LIME.

Chemical Apparatus & Scientific Instruments

PORCELAIN, GLASS, STONE, WOOD, AND METAL APPARATUS

FOR

CHEMICAL AND PHILOSOPHICAL PURPOSES AND LECTURES.

ELECTRICAL, MEDICAL, AND EXPERIMENTAL COILS AND APPARATUS.

BUNSEN'S MODIFIED FILTER PUMPS, from 10s. 8d. to 67s.

ELECTRICAL BATTERIES AND ELEMENTS.

Sets of Apparatus according to Professor Valentin's "Book of Chemistry," and Professor Attfield's "Manual of Chemistry."

Also Sets of Apparatus as required by the Government Schools always ready and kept in stock.

Catalogues and Illustrations will be sent Gratuitously. A Liberal Discount allowed to Wholesale Buyers.

WHOLESALE IMPORTERS AND MANUFACTURERS:

AUG. BEL & CO.,

34, Maiden Lane, Strand, London, W.C.

SOLE AGENTS FOR GRENET'S BATTERIES AND NODOT'S MICROSCOPES.

BISULPHIDE OF CARBON,

PROTOSULPHATE,
RED OXIDE
OXYCHLORIDE
Sulphocyanide,

And every other Mercurial Preparation.

BISULPHITE OF LIME, TETRACHLORIDE OF CARBON
Oxysulphuret of Antimony, Glacial Acetic Acid,

LIQUOR AMMONIÆ,
SULPHIDE OF IRON,
PURE ACIDS,
CHLORIDE OF SULPHUR,
ACETONE,
CHLOROFORM,
ALDEHYDE,
CHLORATE BARYTA,
ARSENIC ACIDS,
FRUIT ESSENCES FOR CONFECTIONERY & LIQUEURS,
PERCHLORIDE OF IRON,
SULPHITE AND HYPOSULPHITE OF SODA,
PHOSPHATES OF SODA AND AMMONIA,
ETHERS,
BROMIDES,
IODIDES,
SCALE AND GRANULAR PREPARATIONS.

ALSO,
Pure Photographic Chemicals of every kind.
MANUFACTURED BY
WILLIAM BAILEY & SON,
HORSELEY FIELDS CHEMICAL WORKS,
WOLVERHAMPTON

JAMES WOOLLEY, SONS, & CO.

69, MARKET STREET, MANCHESTER,

DEALERS IN

CHEMICAL AND SCIENTIFIC APPARATUS
CHEMICAL REAGENTS, &c.,

FOR THE USE OF

ANALYSTS, SCIENCE TEACHERS, AND MANUFACTURERS

Price Lists on application.

THE NEW MINIATURE SPRENGEL PUMP.

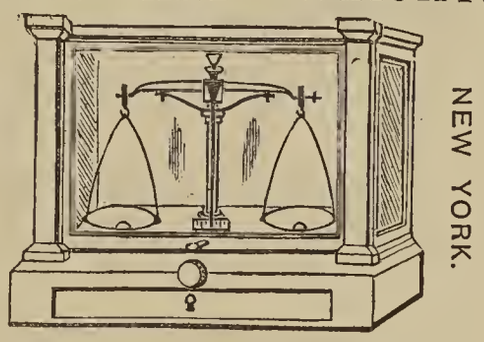
(STEARN AND SWAN'S PATENT.)

As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

BECKER & SONS,

MANUFACTURERS OF

CHEMICAL AND GOLD ASSAY BALANCES
AND OTHER
SCALES AND WEIGHTS.



BECKER'S STUDENT'S BALANCE, in polished mahogany glass case, sliding front, counterpoised, to carry 30 grammes in each pan and turn to ½ milligramme, nickel plated pans.. £2 10
Ditto, ditto, in mahogany glass case, polished black £2 13

Sole Agents for England, Ireland, and Wales:—

TOWNSON & MERCER,

Becker's Complete Lists forwarded by post on receipt of 1d. stamp, or free on application.

S. A. SADLER,

CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Galvanising Salts, Coal-Tar, Pitch Creosote, Grease, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracen and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

Just published, price One Shilling,

TELEPHONES, OLD AND NEW

A Lecture by Professor BARRETT, M.R.I.A.

With Notes and Illustrations.

London: HORATIO YEATES, Optical and Philosophical Instrument Maker, 33, King Street, Covent Garden.

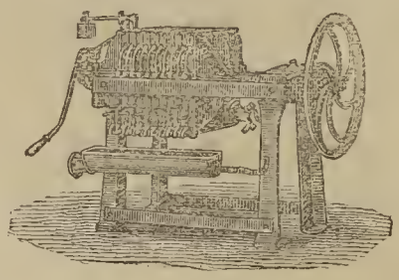
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

The speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE — Lump, Crystallised, Ground, and Prepared. Large stock of every description. *** *Suitable for all Trades.*

ARSENIC — Refined powdered, Lump, Grey, and Ruby.

FLUOR-SPAR — Finest produced. Medium and Common for a purposes.

BARYTES — Carbonate and Sulphate. All qualities of Lump and Ground.

BAUXITE — Of high percentage of Alumina and low in Iron.

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,
MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

H. M. CAPNER,

Electrical and Philosophical Instrument Maker to the Trade only.

20, NORTHAMPTON SQUARE, LONDON E.C

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.

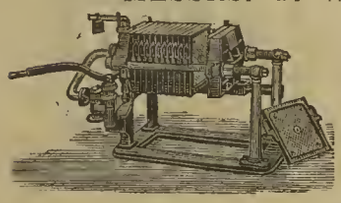
SULPHATE OF AMMONIA, ANTHRACENE BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

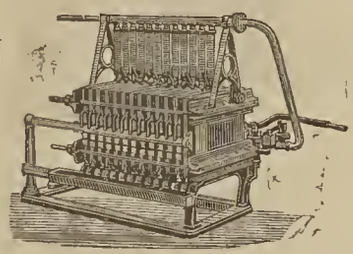
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series of insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Sole Agents for Prof. Wanklyn's Test Solutions or Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM
FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA
FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

Manufactured by the
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.
Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

TAR DISTILLERS
DRYSALTERS
BOUCK & Co LIMITED
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp. Zinc, Nitric Acids &c. &c.
BRIMSTONE REFINERS
Samples & prices on application.
J. J. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE, OXALIC ACID, PICRIC ACID, Sal-Aceto-cell, BICHROME CHLORATE OF POTASH, &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

DOULTON & WATTS

HIGH STREET, LAMBETH, LONDON, S.E.

DEPOTS:—GRANVILLE WHARF, WOOD STREET, BIRMINGHAM; 100, SOHO STREET LIVERPOOL; AND 18, RUE MARTEL, PARIS.

MANUFACTURERS OF

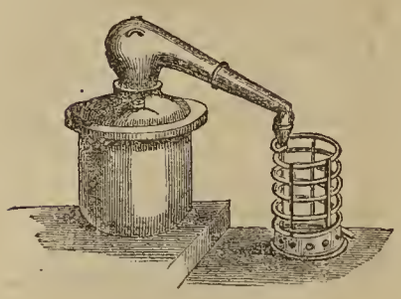
STILLS, RETORTS, CONDENSING WORMS, WOLLF'S BOTTLES

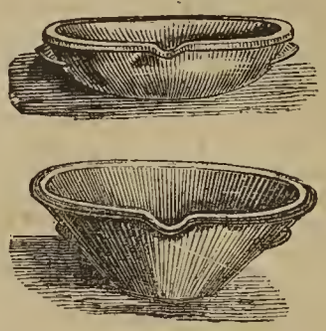
ACID PUMPS, COCKS, PERCOLATORS, AIR-TIGHT JARS,

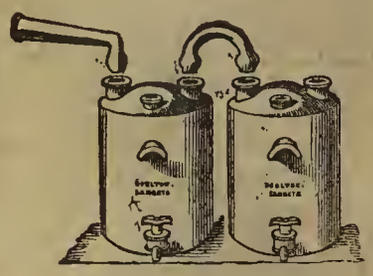
AND EVERY DESCRIPTION OF

STONEWARE FOR CHEMICAL PURPOSES,

Warranted to Resist the Strongest Acids.







PLUMBAGO CRUCIBLES, AND OTHER FIRE-STANDING GOODS.

CHEMISTS' AND DRUGGISTS' GLASS. PORCELAIN TAPS.

PRICE LISTS of any of the above, and of Every Description of Stoneware, may be had on application, and Samples seen at

Messrs. D. and W.'s SHOW ROOMS, HIGH STREET, LAMBETH.

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

MANUFACTURERS OF

PURE CARBOLIC ACID, Cryst. at 42°·2 C. } Discovered by C. Lowe.	CARBOLIC ACID GLYCERINE SOLUTIONS.	BENZOL (Cryst.).
,, ,, do. Hydrate of	CRESYLIC ACID.	ANTHRACENE.
MEDICINAL do. Cryst. at 35° C.	SULPHO-PHENIC ACID (CRYST.	NAPHTHALINE.
COMMERCIAL do. No. 1 ,, 35° C.	SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.	PICRIC ACID (Crysta and Paste).
,, do. 2 ,, 29° C.		AURINE (Rosolic Acid Cake and Solution.
,, do. 3 ,, 12° C.		
,, do. 4 liquid at 0° C.		
CARBOLIC ACID DISINFECTING POWDER.		

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,

OLDBURY, NEAR BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purpose Anthracene, Naphthaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF, STONEWARE MANUFACTURER, { Late JOHN CLIFF & Co. Formerly STEPHEN GREEN. } No. IMPERIAL POTTERIES, LAMBETH. OLD QUAY RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate H E.C March 8, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [*Established Twenty-six Years.*

Vol. 37.—No. 955.] *Copyright reserved.* Friday, March 15, 1878. *Registered as a Newspaper.* [PRICE, 4*d*. POST FREE, 4½*d*

CONTENTS.

ARTICLES:— PAGE
On Dyer's Chemicals, by J. Marzell 105
Tests of the Service of a Domestic Water-Filter 107
The Application of Sonstadt's Solution to the Separation of Minerals for Chemical Analysis, by Edward T. Hardman, F.C.S. 108
On a New Method of Weighing Precipitates, by Arthur W. Clark 109
PROCEEDINGS OF SOCIETIES:—
CHEMICAL SOCIETY.—New Derivatives of Anisoil—Action of Ammonia on Anthrapurpurin—On Certain Poly-Iodides—Improved Form of Washing-Bottle—Preparation of Glycollic Acid 109
MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.—Note on a Method for Determining the Coefficients in Chemical Equations 110
CORRESPONDENCE.—Ammonia in Filtered Water—Chemists and Chemists 111
CHEMICAL NOTICES FROM FOREIGN SOURCES 112
NOTES AND QUERIES.—"Safety Matches" 114

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing rare Elements, &c., for Chemical Purposes, Experiment, and Research.
Also, Elementary Collections of Minerals, Fossils, and Rocks, for Students, Schools, Colleges, &c.
NEW PATTERNS OF GEOLOGICAL HAMMERS.
NEW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
88, CHARLOTTE STREET, FITZROY SQUARE.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

Just published, price 2s. 6d.

THE LONDON WATER SUPPLY. By CHARLES MEYMOTT TIDY, M.B., Professor of Chemistry at the London Hospital.

London: J. and A. CHURCHILL.

MACTEAR'S PATENT CARBONATING FURNACE,
AND
JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,
MANUFACTURED BY
R. DAGLISH & CO.,
ST. HELEN'S ENGINE AND BOILER WORKS,
LANCASHIRE.

Prices and other particulars on application.

An Analytical Chemist (age 21), with several years' experience in a laboratory, seeks an Engagement as Chemist in Works or as Assistant in a Laboratory.—Address, H. H. W., 344, Glossop Road, Sheffield.

PARTNERSHIP.

An Analytical Chemist, F.C.S., wishes to obtain a working Partnership by investing a sum of money in the business of a well-established laboratory; London preferred.—Apply, A. N. Z., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

A Gentleman desires an Appointment as Analyst in a Chemical Laboratory or Works. Has had some experience in teaching, and holds high class testimonials. No objection to go abroad.—Address, N. R. E., F.C.S., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

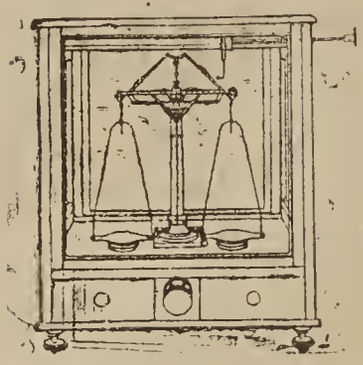
A Young German Chemist (Ph.D., Leipzig) seeks an Engagement in a Chemical Manufactory.—Address, R. J., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

FOR SALE BY PRIVATE CONTRACT

Two Revolving Ball Furnaces, 15·6 long by 9 ft. diam.; Shell of § Boiler-plate bound by metal rings and malleable iron tyres, carrying wheels of metal with iron tyres; Solid Scroll Wheel on Shell for driving, also gearing for quick and slow speeds, &c.—May be seen at work and further particulars obtained on application to the Jarrow Chemical Co., South Shields.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. **Pamphlet** containing special advice, gratis or by post.—166, **Fleet Street** London.



L. OERTLING,

TURNMILL STREET

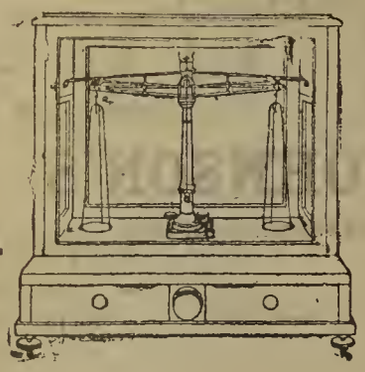
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH. FUSEL OIL and RECT. NAPHTHA.

DO YOUR OWN PRINTING.

The "Optimus" Printing-Press for Amateurs. Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A HERBERT, Printing Warehouse, 50, Finsbury Square, London, E.C

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS, LIQUOR AMMONIA, &c.

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

BISULPHITE OF LIME.

BISULPHITE OF SODA.

WILLIAM MARRIOTT

CHEMICAL WORKS HUDDERSFIELD

CÖTHEN.

F. Chemiker, Techniker, Fabrik., Ingenieure, Apotheker, Aerzte, Landwirthe. Chemisches Central-Annoncenblatt. Erscheint wöchentl. Durch j. Postanst. u. Buchhdl. zu beziehen. Preis viertelj. 2,50 M., durch Streifb. 3 M., nach dem Auslande 4,00 M. ANZEIGEN: 30 Pf. p. Zeile. Probenummern kostenfrei!

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

---

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

South London School of Pharmacy, 325, Kennington Road. Managing Director, DR. MUTER.

Daily Lectures on the following subjects:—

CHEMISTRY.	MATERIA MEDICA.
BOTANY.	PHARMACY.
PHYSICS.	CLASSICS.

The School has accommodation for 120 Students, and contains an excellent Museum and a very completely fitted Chemical Laboratory for 50 Junior and 20 Senior Pupils, with water and gas at every working bench.

For all particulars, enclose a stamped envelope to the Secretary, Mr. W. BAXTER, at his office, Central Public Laboratory, Kennington Cross, London, S.E.

CHEMISTS AND MANUFACTURERS

Are solicited, before purchasing FILTER-PRESSES, to examine the merits of

JOHNSON'S PATENT HYDRAULIC FILTER,

And see whether, for—

CORRECTNESS OF PRINCIPLE,
DESIGN,
CONVENIENCE AND ECONOMY IN WORKING,
SOLIDITY AND EXCELLENCE OF WORKMANSHIP,
AND LOWNESS OF PRICE,

t is not by far the BEST, CHEAPEST, and MOST RAPID MEANS OF FILTRATION IN THE MARKET, for—

SEPARATING SOLIDS FROM SEMI-FLUIDS,
FILTERING LIQUIDS BRIGHT,
WASHING PRECIPITATES,
DRYING PRECIPITATES, SLURRY OR SLUDGE.

in any quantities, large or small, with great economy in cloths, which never burst and are easily removed for cleaning when required. These are advantages which command its adoption over every other form of Filter.

Trials at the Works made Gratis in presence of Intending Purchasers.

Small Filter-Press for Laboratory Use, with Pump complete ... ... from £7.

JOHNSON'S ENGINEERING WORKS,
CARPENTER'S ROAD, STRATFORD.
LONDON OFFICES - - - - - - - N. NUTTER, 71, CORNHILL, E.C.

CALVERT'S CARBOLIC ACID.

HIGHEST PRIZE MEDAL AT PARIS EXHIBITION, 1867.
GOLD AND SILVER MEDALS, HAVRE, 1868. DIPLOME D'EXCELLENCE, AMSTERDAM
SILVER MEDAL, FIRST CLASS, NAPLES, 1871. GOLD MEDAL, MOSCOW, 1872.

F. C. CALVERT & CO., of Bradford, Manchester (original and only Manufacturers of pure Medical Carbolic Acid), beg to inform the Trade and large Consumers that their pure Medical Carbolic as well as cheaper qualities for Commercial, Veterinary, and Disinfecting Purposes, also Carbolic Acid Soaps for Medical, Toilet, and General Use, Soft Soap Dogs, and Carbolic Acid Disinfecting Powder, may be had from any of the below-named Wholesale Agents—

Apothecaries' Soc., Lond'n	Clarke, Bleasdale, & Co.	Hodgkinsons, Preston, & King	W. Mather	James Sim & Co,
Apothecaries' Co., Glasg'w	Clay, Dod, & Case	Hearon, Squire, & Francis	McMaster, Hodgson, & Co.	Sang & Barker
Apothecaries' Hall, Dublin	Dakin Brothers	Hopkin & Williams	J. F. Macfarlan & Co.	Southall, Bros., & Co.
Allen & Hanburys	Davy, Yates, & Co.	Howards & Sons	J. Mackay	W. Smeeton
J. Bell & Co.	Duncan, Flockhart, & Co.	Hirst, Brooke, & Co.	R. H. Millard & Son	Slinger & Barnett
Barron, Harveys, & Co.	W. Edwards & Son	Mackey, Sellers, & Co.	Mottershead & Co.	P. Sandeman & Co.
Barclay & Sons.	Evans, Lescher, & Evans	W. R. Hatrick & Co.	Newbery & Sons	Tidman & Son
Burgoyne & Co.	Evans, Sons, & Co.	P. Harris & Co.	Paterson & Son	Taylor, Gibson, & Co.
Baiss Brothers & Co.	Evans, Gadd, & Co.	Hunt & Co.	Raimes & Co.	Thacker & Hoffe
Barron, Squire, & Co.	Ferris & Co.	J. Ismay	J. Richardson & Co.	Jas. Taylor
Battley & Watts	Glasgow New Apoth. Co.	Johnson & Sons	Raimes, Blanshards, & Co.	J. Woolley, Sons, & Co
Bewley & Draper	General Apothecaries' Co.	Langtons, Edden, & Hicks	J. Reddish & Co.	Wyleys & Co.
H. B. Brady	W. & H. M. Goulding	Lynch & Co.	Sanger & Sons	Wilson & Kitchen
Bainbridge & Pound	Goodall, Backhouse, & Co.	Lofthouse & Saltmer	Savory & Moore.	C. H. Warner & Co.
Boileau & Boyd	Grimwade, Ridley, & Co.	Chas. Leslie	W. Sutton & Co.	A. & J. Warren
Curling & Co.	Hodgkinsons, Stead, & Co.	Maw, Son, & Thompson	R. Sumner & Co.	Walkington & Son
Corbyn & Co.	Herrings & Co.	H. C. Mason		Wright, Layman, & Umney

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Galvanising Salts, Coal-Tar, Pitch Creosote, Grease, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracen and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

MILTON CHEMICAL WORKS,
STOKE-ON-TRENT,
STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

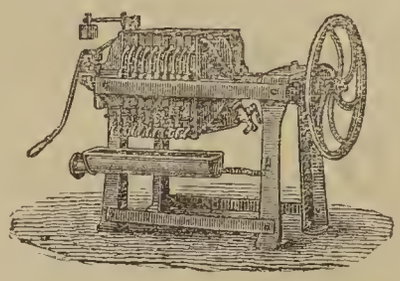
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

THE speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE — Lump, Crystallised, Ground, and Prepar Large stock of every description. *** *Suitable for all Trades.*

ARSENIC — Refined powdered, Lump, Grey, and Ruby.

FLUOR-SPAR — Finest produced. Medium and Common for all purposes.

BARYTES — Carbonate and Sulphate. All qualities of Lump and Ground.

BAUXITE — Of high percentage of Alumina and low in Iron;

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,
MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

H. M. CAPNER,

Electrical and Philosophical Instrument Maker to the Trade only.

20, NORTHAMPTON SQUARE, LONDON E.C

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

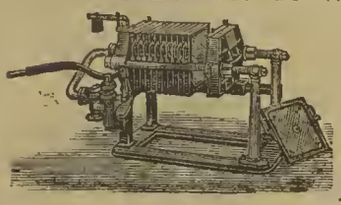
POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE
BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

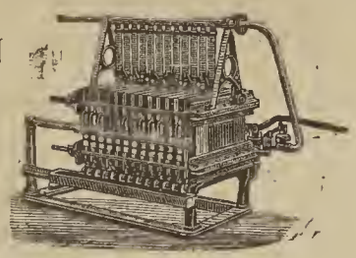
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

THE CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	a.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

heques and Post-Office Orders, crossed "London and County k," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),

Wholesale and Export Dealers and Manufacturers of

CHEMICAL & SCIENTIFIC APPARATUS

Graduated Instruments, Pure Chemicals, &c.,

Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,

89, Bishopsgate Street Within,
LONDON.

Sole Agents for Prof. Wanklyn's Test Solutions or Water Analysis

Illustrated Catalogue post ree on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM
FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA
FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

Manufactured by the

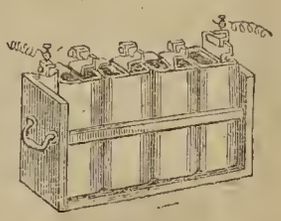
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.

Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

CHEMICAL & SCIENTIFIC APPARATUS,

WHOLESALE AND RETAIL.

EVERY DESCRIPTION OF APPARATUS FOR STUDY, LECTURES, OR RESEARCH.



Country Orders, accompanied by a remittance, executed same day as received; and carriage paid in England and Wales if over £2 in value.

PRICE LISTS POST FREE ON APPLICATION.

M. JACKSON AND CO.,
65, BARBICAN, LONDON.

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,
(Established 1860.)

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

MANUFACTURERS OF

Pure Carbolic Acid, Cryst. at 42°·2 C. } Discovered by C. Lowe.
,, ,, do. Hydrate of
Medicinal do. Cryst. at 35° C.
Commercial do. No. 1 ,, 35° C.
,, do. 2 ,, 29° C.
,, do. 3 ,, 12° C.
,, do. 4 liquid at 0° C.
Carbolic Acid Disinfecting Powder.

Carbolic Acid Glycerine Solutions.
Cresylic Acid.
Sulpho-Phenic Acid (Cryst.
Sulpho-Phenates & Sulpho-Cresylates of Soda, Potash, Zinc, Iron, and Alumina.

Benzol (Cryst.).
Anthracene.
Naphthaline.
Picric Acid (Crystal and Paste).
Aurine (Rosolic Acid Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,
OLDBURY, near BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purposes Anthracene, Naphthaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF,
STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY
RUNCORN.

London: Printed and Published for the Proprietor by Edwin John Davey, at the Office, Boy Court, Ludgate Hill, E.C
March 15, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [*Established Twenty-six Years.*

Vol. 37.—No. 956.] *Copyright reserved.* Friday, March 22, 1878. *Registered as a Newspaper.* [PRICE, 4*d*. POST FREE, 4½*d*.

CONTENTS.

ARTICLES:— PAGE
Short Reports from the Chemical Laboratory of Trinity College, Dublin, by J. Emerson Reynolds, M.D..... 115
A New Method of Weighing Precipitates, by Charles F. Cross... 116
Notes on the Loss of Nitre in the Vitriol Manufacture, by George E. Davis..... 117
PROCEEDINGS OF SOCIETIES:—
PHYSICAL SOCIETY.—Transmission of Vocal and other Sounds by Wires—Production of Thermo-electric Currents in Wires Subjected to Mechanical Strain..... 117
UNIVERSITY COLLEGE CHEMICAL AND PHYSICAL SOCIETY..... 118
NOTICES OF BOOKS.—Photographed Spectra—Year-Book of Pharmacy—Proceedings of the Twenty-fifth Annual Meeting of the American Pharmaceutical Association..... 118
CORRESPONDENCE 120
CHEMICAL NOTICES FROM FOREIGN SOURCES..... 121

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

PARTNERSHIP.

An Analytical Chemist, F.C.S., wishes to obtain a working Partnership by investing a sum of money in the business of a well-established laboratory; London preferred.—Apply, A. N. Z., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

£2500 to £5000 can be invested with option of Partnership in a Manufacturing Business near London, connected with the manure trade. The business already gives a safe and certain income, which can be increased, and it is desired to work another branch estimated to yield a large fortune in a few years.—Address, Ammonia, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London E.C.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

Sixth Edition Illustrated.
Post 8vo., Price 15s.

ATTFIELD'S CHEMISTRY,
GENERAL, MEDICAL, AND PHARMACEUTICAL.

"For all the numerous class of students who are preparing for the medical or for the pharmaceutical profession, we know of no work in the language which can be compared with the one before us."—*Chemical News.*

"Written with a just appreciation of the small amount of time for the study of chemistry at the disposal of the student in medicine and pharmacy.—*Nature.*

JOHN VAN VOORST, 1, PATERNOSTER ROW.
The Seventh Edition, specially arranged for American Students, is published by Lea, Philadelphia.

MACTEAR'S PATENT CARBONATING FURNACE,
AND
JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,
MANUFACTURED BY
R. DAGLISH & CO.,
ST. HELEN'S ENGINE AND BOILER WORKS,
LANCASHIRE.
Prices and other particulars on application.

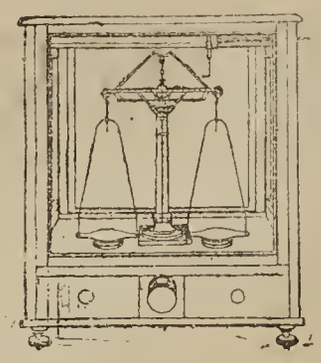
An Analytical Chemist (age 21), with several years' experience in a laboratory, seeks an Engagement as Chemist in Works or as Assistant in a Laboratory.—Address, H. H. W., 344, Glossop Road, Sheffield.

An Experienced Manager and Analyst in the manufacture of phosphatic manures, olive oil, blue, mottled, and yellow soaps, and who has worked the bisulphide of carbon process for the separation of fats, is open to an Engagement at home or abroad; no objection to office work.—F.C.S., 1, Coleherne Road, London, S.W.

A Young Gentleman (19), who has studied chemistry—analytical and technological—three years and a half under distinguished Professors, desires a situation in works where his knowledge would be of use.—Address, J., 77, Grosvenor Street, C.-on-M., Manchester.

TO ANALYTICAL CHEMISTS, &c.

A Gentleman in practice in London is open to assist any analytical chemist, either in London or country, for a few days when busy: terms moderate.—X., care of Mr. J. H. Martin, York Chambers, Adelphi, W.C.



L. OERTLING,

TURNMILL STREET

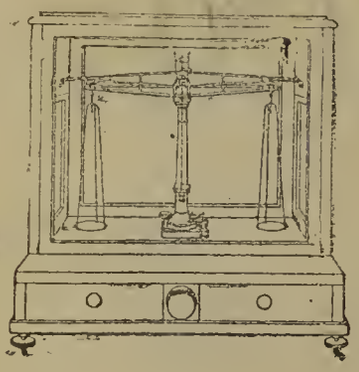
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E. Also FINISH, FUSEL OIL and RECT. NAPHTHA.

DO YOUR OWN PRINTING.

The "Optimus" Printing-Press for Amateurs. Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A. HERBERT, Printing Warehouse, 50, Finsbury Square, London, E.C.

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS, LIQUOR AMMONIA, &c.

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

BISULPHITE OF LIME.

BISULPHITE OF SODA.

WILLIAM MARRIOTT

CHEMICAL WORKS HUDDERSFIELD

CÖTHEN.

F. Chemiker, Techniker, Fabrik., Ingenieure, Apotheker, Aerzte, Landwirthe. Chemisches Central-Annoncenblatt. Erscheint wöchentl. Durch j. Postanst. u. Buchhdl. zu beziehen. Preis viertelj. 2,50 M., durch Streifb. 3 M., nach dem Auslande 4,00 M. ANZEIGEN: 30 Pf. p. Zeile. Probenummern kostenfrei!

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

---

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

A. BOAKE & CO.,

STRATFORD, LONDON, E.,

MAKERS OF

THE SULPHITES AND BISULPHITES

OF

SODA AND LIME.

BECKER & SONS,

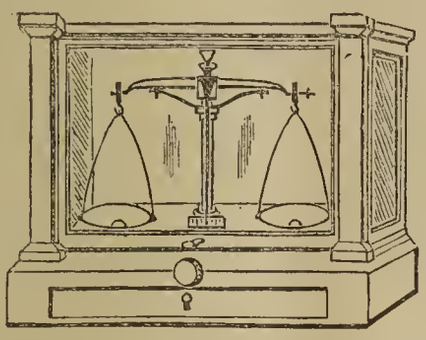
MANUFACTURERS OF

CHEMICAL AND GOLD ASSAY BALANCES

AND OTHER

SCALES AND WEIGHTS.

ROTTERDAM.



NEW YORK.

BECKER'S STUDENT'S BALANCE, in polished mahogany glass case, sliding front, counterpoised, to carry 30 grammes in each pan and turn to ½ milligramme, nickel plated pans..£2 10
Ditto, ditto, in mahogany glass case, polished black £2 13

Sole Agents for England, Ireland, and Wales :—

TOWNSON & MERCER,

Becker's Complete Lists forwarded by post on receipt of 1*d.* stamp, or free on application.

BISULPHIDE OF CARBON,
PROTOSULPHATE,
RED OXIDE
OXYCHLORIDE

Sulphocyanide,

And every other Mercurial Preparation.

BISULPHITE OF LIME, TETRACHLORIDE OF CARBON

Oxysulphuret of Antimony, Glacial Acetic Acid,

LIQUOR AMMONIÆ,
SULPHIDE OF IRON,
PURE ACIDS,
CHLORIDE OF SULPHUR,
ACETONE,
CHLOROFORM,
ALDEHYDE,
CHLORATE BARYTA,
ARSENIC ACIDS,
FRUIT ESSENCES FOR CONFECTIONERY & LIQUEURS,
PERCHLORIDE OF IRON,
SULPHITE AND HYPOSULPHITE OF SODA,
PHOSPHATES OF SODA AND AMMONIA,
ETHERS,
BROMIDES,
IODIDES,
SCALE AND GRANULAR PREPARATIONS.

ALSO,

Pure Photographic Chemicals of every kind.

MANUFACTURED BY

WILLIAM BAILEY & SON,

HORSELEY FIELDS CHEMICAL WORKS,
WOLVERHAMPTON

THE NEW MINIATURE SPRENGEL PUMP.

(STEARN AND SWAN'S PATENT.)

As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

ERECTION OF PLANT.

TO SULPHATE OF AMMONIA MANUFACTURERS AND OTHERS.

STILLS, SATURATORS, and all APPARATUS in connection with the above Erected upon the Most Approved Plan—result of 15 years practical experience.—Address, G. Tunbridge, Man. Chem. Dept., Gas Works, Leicester, or Barnes, Plumber, &c., Barking, Essex.

Chemical Technology, or Chemistry in its Applications to the Arts and Manufactures. By THOMAS RICHARDSON and HENRY WATTS. Second Edition, illustrated ith numerous Wood Engravings.

Vol. I., Parts 1 and 2, price 36s., with more than 400 Illustrations.

Nature and Properties of Fuel: Secondary Products obtained from Fuel: Production of Light: Secondary Products of the Gas Manufacture.

Vol. I., Part 3, price 33s., with more than 300 Illustrations.

Sulphur and its Compounds: Acidimetry: Chlorine and its Bleachin Compounds: Soda, Potash: Alkalimetry: Grease.

Vol. I., Part 4, price 21s., 300 Illustrations.

Aluminium and Sodium: Stannates, Tungstates, Chromates, and Silicates of Potash and Soda: Phosphorus, Borax: Nitre: Gun-Powder: Gun Cotton.

Vol. I., Part 5, price 36s.

Prussiate of Potash: Oxalic, Tartaric, and Citric Acids, and Appendices containing the latest information, and pecifications relating to the matcrials described in Parts 3 and 4.

BAILLIERE AND CO., 20, King William Street, Strand.

South London School of Pharmacy, 325, Kennington Road. Managing Director, DR. MUTER.
Daily Lectures on the following subjects:—

CHEMISTRY.	MATERIA MEDICA.
BOTANY.	PHARMACY.
PHYSICS.	CLASSICS.

The School has accommodation for 120 Students, and contains an excellent Museum and a very completely fitted Chemical Laboratory for 50 Junior and 20 Senior Pupils, with water and gas at everyworking bench.

For all particulars, enclose a stamped envelope to the Secretary, Mr. W. BAXTER, at his office, Central Public Laboratory, Kennington Cross, London, S.E.

S. A. SADLER,

CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene ,Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Galvanising Salts, Coal-Tar, Pitch Creosote, Grease, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracen and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

JAMES WOOLLEY, SONS, & CO.

69, MARKET STREET, MANCHESTER,

DEALERS IN

CHEMICAL AND SCIENTIFIC APPARATUS
CHEMICAL REAGENTS, &c.,

FOR THE USE OF

ANALYSTS, SCIENCE TEACHERS, AND MANUFACTURERS

Price Lists on application.

MILTON CHEMICAL WORKS,
STOKE-ON-TRENT,
STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

J. I. HEADLY, ENGINEER, Cambridge, Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

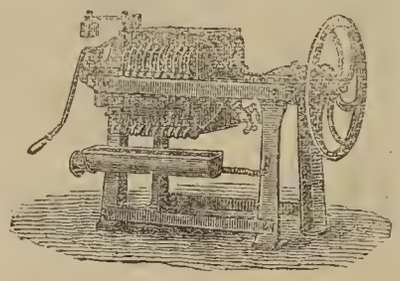
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

THE speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE — Lump, Crystallised, Ground, and Prepar Large stock of every description. *** *Suitable for all Trades.*

ARSENIC — Refined powdered, Lump, Grey, and Ruby.

FLUOR-SPAR — Finest produced. Medium and Common for all purposes.

BARYTES — Carbonate and Sulphate. All qualities of Lump and Ground.

BAUXITE — Of high percentage of Alumina and low in Iron.

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,
MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

H. M. CAPNER,

Electrical and Philosophical Instrument Maker to the Trade only.

20, NORTHAMPTON SQUARE, LONDON E.C

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.

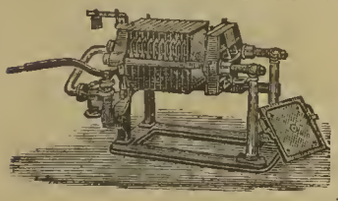
SULPHATE OF AMMONIA, ANTHRACENE, BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

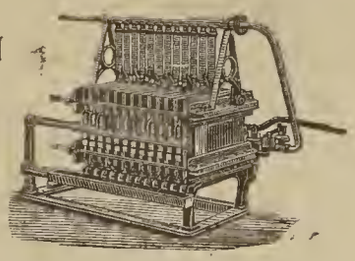
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

heques and Post-Office Orders, crossed "London and County k," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

TOWNSON & MERCER
(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Sole Agents for Prof. Wanklyn's Test Solutions or Water Analysis

Illustrated Catalogue post ree on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM
FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA
FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

Manufactured by the
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.
Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

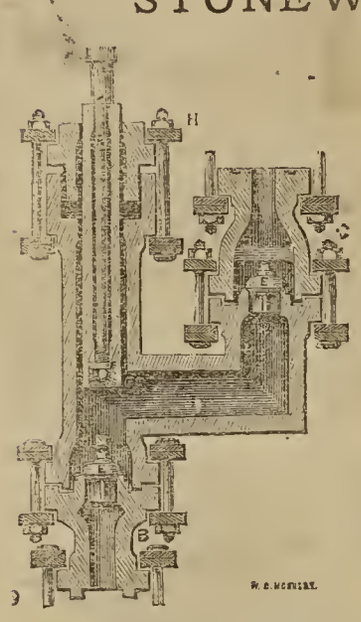
TAR DISTILLERS
DRYSALTERS
BOUCK & Co LIMITED
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp Zinc. Nitric Acids, &c. &c
BRIMSTONE REFINERS
Samples & prices on application.
J. J. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID, PICRIC ACID, Sal-Acetasecin BICHROME CHLORATE OF POTASH &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

DOULTON & WATTS

HIGH STREET, LAMBETH, LONDON, S.E.

MANUFACTURERS OF

STONEWARE ACID PUMPS AND COCKS,

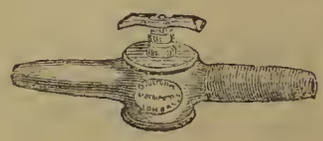


STILLS, RETORTS, CONDENSING WORMS

WOLFF'S BOTTLES

PERCOLATORS, AIR-TIGHT JARS,

And every description of Stoneware or Chemical Purposes, warranted to resist the strongest acids.



PLUMBAGO CRUCIBLES AND OTHER FIRE-STANDING GOODS.

CHEMISTS' & DRUGGISTS' GLASS. PORCELAIN TAPS

Price Lists of any of the above, and of every description of Stoneware, may be had on application.

Messrs. D. and W. were awarded a MEDAL for ACID PUMPS, and also one for PLUMBAGO CRUCIBLES, at the Vienna Exhibition, 1873.

Head Offices and Show Rooms, HIGH STREET, LAMBETH, S.E.

Depots :—Granville Wharf, Wood Street, Birmingham; 100, Soho Street, Liverpool ; Hope Street, Salford Manchester ; and 6, Rue de Paradis Poissonière, Paris.

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

MANUFACTURERS OF

PURE CARBOLIC ACID, Cryst. at 42°·2 C.	Discovered by C. Lowe.	CARBOLIC ACID GLYCERINE SOLUTIONS.
,, ,, do. Hydrate of		CRESYLIC ACID.
MEDICINAL do. Cryst. at 35° C.		SULPHO-PHENIC ACID (CRYST.
COMMERCIAL do. No. 1 ,, 35° C.		SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.
,, do. 2 ,, 29° C.		
,, do. 3 ,, 12° C.		
,, do. 4 liquid at 0° C.		
CARBOLIC ACID DISINFECTING POWDER.		

BENZOL (Cryst.).
ANTHRACENE.
NAPHTHALINE.
PICRIC ACID (Crystal and Paste).
AURINE (Rosolic Acid Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,

OLDBURY, NEAR BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purpose Anthracene, Naphtinaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF, STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate Hill, E C
March 22, 1878.

OF GREAT BRITAIN

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [*Established Twenty-six Years.*

Vol. 37.—No. 957.] *Copyright reserved.* Friday, March 29, 1878. *Registered as a Newspaper.* [PRICE, 4*d*. POST FREE, 4½*d*.

CONTENTS.

ARTICLES:— PAGE
On the Composition of the Vitriol Running from Absorbing and Denitrating Towers, by George E. Davis 125
Possible Use for a Constituent of Gas-Lime, by Thomas Douglas 126
Analyses of Cane and Beet-Root Sugar Ash, by J. W. Macdonald 127
On the Sulphates of the Vanadium Pentoxide, by Dr. B. W. Gerland 127
PROCEEDINGS OF SOCIETIES:—
CHEMICAL SOCIETY.—Aromatic Nitrosamines—New Process for the Volumetric Estimation of Cyanides—Certain Bismuth Compounds 128
EDINBURGH UNIVERSITY CHEMICAL SOCIETY.—Salts of Trimethyl-sulphine—Cooling of Fats 130
CORRESPONDENCE.—Chemists and Chemists 131
CHEMICAL NOTICES FROM FOREIGN SOURCES 133

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

An Analytical Chemist (age 21), with several years' experience in a laboratory, seeks an Engagement as Chemist in Works or as Assistant in a Laboratory.—Address, H. H. W., 344, Glossop Road, Sheffield.

An Analytical Chemist (30), of considerable experience in works and private laboratories, is open for an Engagement as Chemist or Sub-manager: first class testimonials.—Address, Chemist, care of Messrs. Porteous and Co., Exchange Place, Glasgow.

Wanted to Purchase—a Second-hand Rolling-Mill for Assaying.—Address, stating terms and giving description, M. M. P. Muir, Caius College, Cambridge.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.

SECOND EDITION.

Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:

ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.

Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.

Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

THE

QUARTERLY JOURNAL OF SCIENCE.

Edited by WILLIAM CROOKES, F.R.S., &c

Now ready No. LVIII., *April*, 1878, price 5s.

CONTENTS.

I. Economy of Nitrogen.
II. On the Movements of Microscopic Particles Suspended in Liquids. By Prof. W. Stanley Jevons, LL.D., M.A., F.R.S.
III. Energy and Feeling: Alternate and Mutually Convertible Affections of Matter. By W. S. Duncan.
IV. The Gold and Placer Mines of Wicklow. By G. H. Kinahan, M.R.I.A., &c.
V. On the Relation of Moisture in Air to Health and Comfort. By Robt. Briggs, C.E.
VI. On Space of Four Dimensions. By Prof. J. C. Friedrich Zöllner. (With Page Plate.)
VII. Liquefaction of Oxygen. By M. Raoul Pictet. (Illustrated.)
VIII. The Phonograph. (Illustrated.)

Notices of Scientific Works, Scientific Notes, &c.

London: 3, Horse-Shoe Court, Ludgate Hill, E.C.

Just published, price 2s. 6d.

THE LONDON WATER SUPPLY. By CHARLES MEYMOTT TIDY, M.B., Professor of Chemistry at the London Hospital.

London: J. and A. CHURCHILL.

PARTNERSHIP.

An Analytical Chemist, F.C.S., wishes to obtain a working Partnership by investing a sum of money in the business of a well-established laboratory; London preferred.—Apply, A. N. Z., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

MACTEAR'S PATENT CARBONATING FURNACE,

AND

JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,

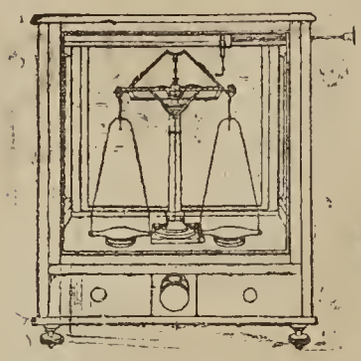
MANUFACTURED BY

R. DAGLISH & CO.,

ST. HELEN'S ENGINE AND BOILER WORKS,

LANCASHIRE.

Prices and other particulars on application.



L. OERTLING,

TURNMILL STREET

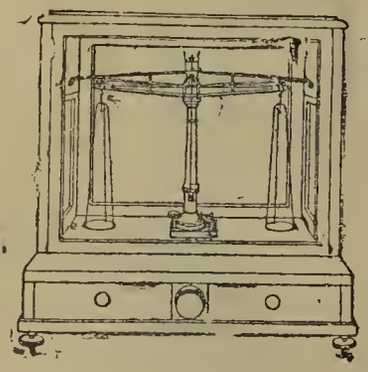
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Salt Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA.

DO YOUR OWN PRINTING.

The "Optimus" Printing-Press for Amateurs. Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A HERBERT, Printing Warehouse, 50, Finsbury Square, London, E.C

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS LIQUOR AMMONIA, &c.

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

BISULPHITE OF LIME.

BISULPHITE OF SODA.

WILLIAM MARRIOTT

CHEMICAL WORKS HUDDERSFIELD

F. Chemiker, Techniker, Fabrik., Ingenieure, Apotheker, Aerzte, Landwirthe. Chemisches Central-Annoncenblatt. Erscheint wöchentl. Durch j. Postanst. u. Buchhdl. zu beziehen. Preis viertelj. 2,50 M., durch Streifb. 3 M., nach dem Auslande 4,00 M. ANZEIGEN: 30 Pf. p. Zeile. Probenummern kostenfrei!

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

---

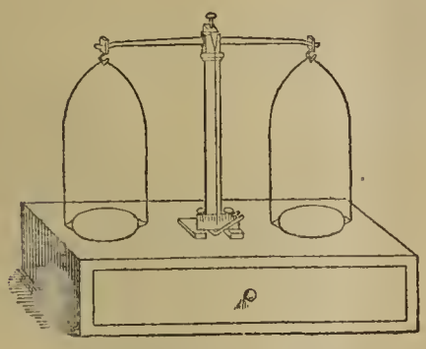
Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

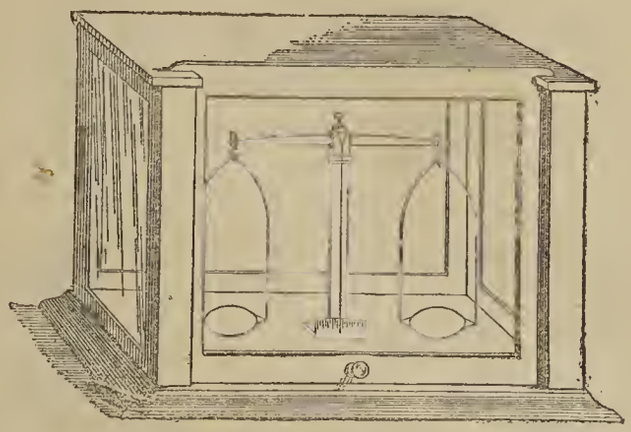
GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays..	..	£2 2 0
200 Specimens, in Cabinet, with 5 Trays..	..	5 5 0
300 Specimens, in Cabinet, with 9 Drawers	..	10 10 0
400 Specimens, in Cabinet, with 13 Drawers	..	21 0 0

More extensive Collections at 50 to 5000 Guineas each.

J. I. HEADLY, ENGINEER, Cambridge, Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

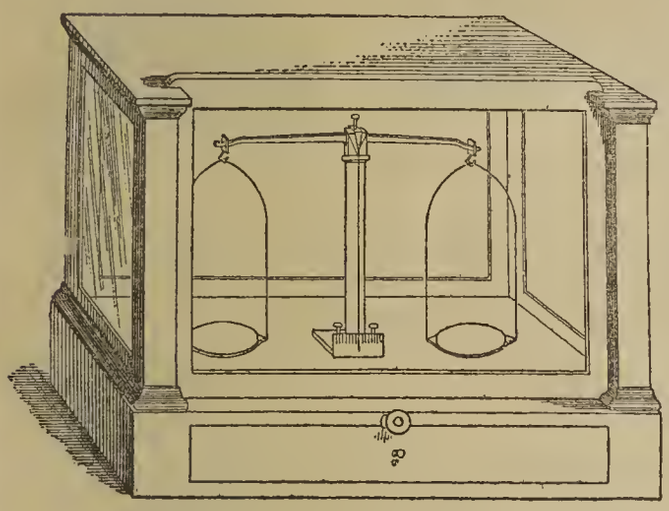


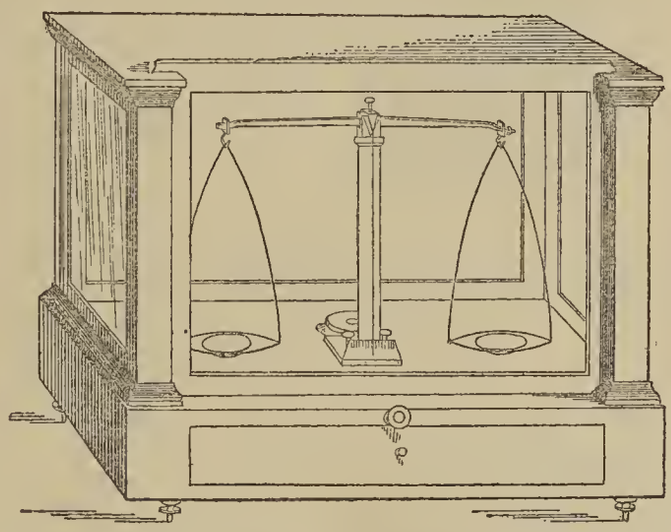


ALABASTER AND CO.,

BALANCE MAKERS TO THE TRADE,

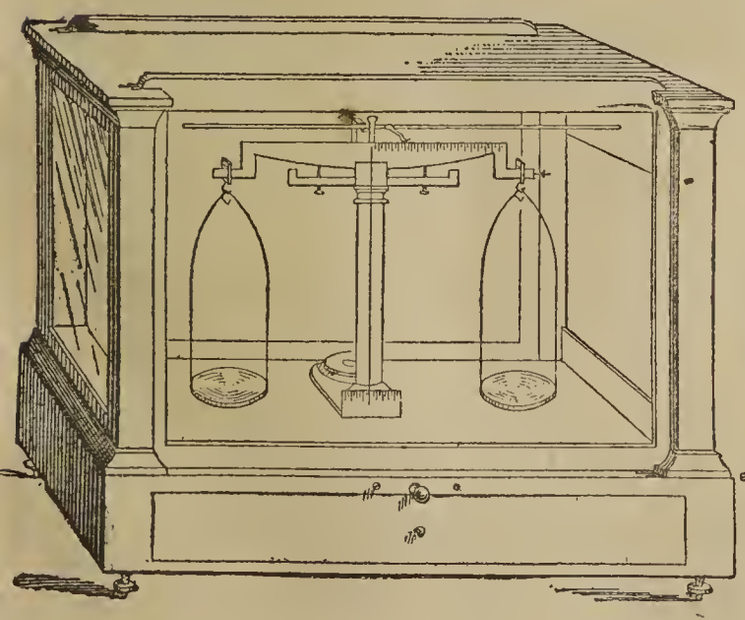
44, GLOUCESTER STREET, QUEEN SQUARE, LONDON, W.C.,

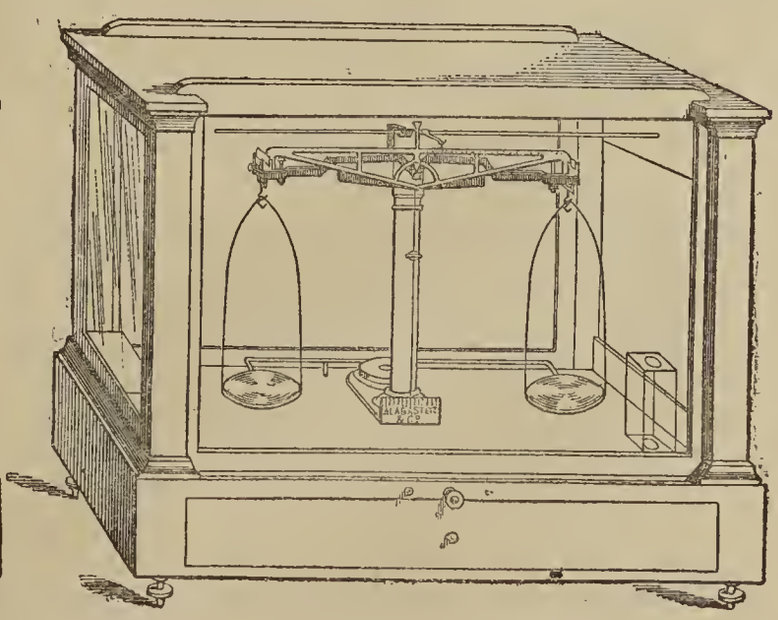




CHEMICAL and ASSAY BALANCES from 31s. 6d. to £30.

Illustrated Price Lists on application.





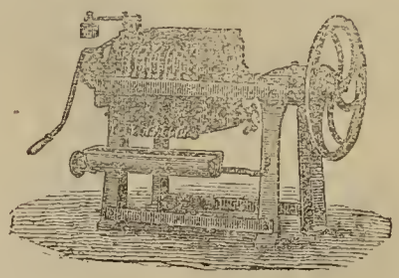
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

THE speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE — Lump, Crystallised, Ground, and Prepar Large stock of every description. *** *Suitable for all Trades.*

ARSENIC — Refined powdered, Lump, Grey, and Ruby.

FLUOR-SPAR — Finest produced. Medium and Common for al purposes.

BARYTES — Carbonate and Sulphate. All qualities of Lump and Ground.

BAUXITE — Of high percentage of Alumina and low in Iron:

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,
MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

H. M. CAPNER,

Electrical and Philosophical Instrument Maker to the Trade only.

20, NORTHAMPTON SQUARE, LONDON E.C

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.

SULPHATE OF AMMONIA, ANTHRACENE BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

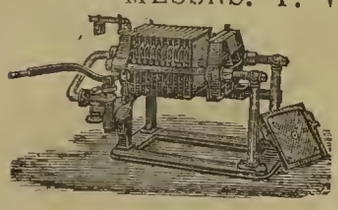
IMPROVED FILTER-PRESSES.

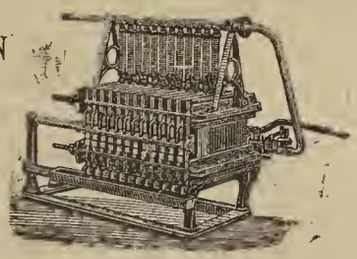
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON

Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.





WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	a.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

heques and Post-Office Orders, crossed "London and County k," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

TOWNSON & MERCER
(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
ole Agents for Prof. Wanklyn's Test Solutions or Water Analysis

Illustrated Catalogue post ree on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

Manufactured by the
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.
Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

TAR DISTILLERS
BOUCK & Co LIMITED
MILES PLATTING,
MANCHESTER
DRYSALTERS
1862 LONDINI HONORIS CAUSA
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp Zinc Nitric Acids &c &c.
BRIMSTONE REFINERS
Samples & prices on application.
J. J. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID, PICRIC ACID, Sal-Acetosell BICHROME CHLORATE OF POTASH, &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

CALVERT'S CARBOLIC ACID.

HIGHEST PRIZE MEDAL AT PARIS EXHIBITION, 1867.

GOLD AND SILVER MEDALS, HAVRE, 1868. DIPLOME D'EXCELLENCE, AMSTERDAM
SILVER MEDAL, FIRST CLASS, NAPLES, 1871. GOLD MEDAL, MOSCOW, 1872.

F. C. CALVERT & CO., of Bradford, Manchester (original and only Manufacturers of pure Medical Carbolic Acid), beg to inform the Trade and large Consumers that their pure Medical Carbolic as well as cheaper qualities for Commercial, Veterinary, and Disinfecting Purposes, also Carbolic Acid Soaps for Medical, Toilet, and General Use, Soft Soap o Dogs, and Carbolic Acid Disinfecting Powder, may be had from any of the below-named Wholesale Agents—

Apothecaries' Soc., Lond'n
Apothecaries' Co., Glasg'w
Apothecaries' Hall, Dublin
Allen & Hanburys
J. Bell & Co.
Barron, Harveys, & Co.
Barclay & Sons.
Burgoyne & Co.
Baiss Brothers & Co.
Barron, Squire, & Co.
Battley & Watts
Bewley & Draper
H. B. Brady
Bainbridge & Pound
Boileau & Boyd
Curling & Co.
Corbyn & Co.
Clarke, Bleasdale, & Co.
Clay, Dod, & Case
Dakin Brothers
Davy, Yates, & Co.
Duncan, Flockhart, & Co.
W. Edwards & Son
Evans, Lescher, & Evans
Evans, Sons, & Co.
Evans, Gadd, & Co.
Ferris & Co.
Glasgow New Apoth. Co.
General Apothecaries' Co.
W. & H. M. Goulding
Goodall, Backhouse, & Co.
Grimwade, Ridley, & Co.
Hodgkinsons, Stead, & Co.
Herrings & Co.
Hodgkinsons, Preston, & King
Hearon, Squire, & Francis
Hopkin & Williams
Howards & Sons
Hirst, Brooke, & Co.
W. R. Hatrick & Co.
P. Harris & Co.
Hunt & Co.
J. Ismay
Johnson & Sons
Langtons, Edden, & Hicks
Lynch & Co.
Lofthouse & Saltmer
Chas. Leslie
Maw, Son, & Thompson
H. C. Mason
W. Mather
McMaster, Hodgson, & Co.
J. F. Macfarlan & Co.
J. Mackay
R. H. Millard & Son
Mackey, Sellers, & Co.
Mottershead & Co.
Newbery & Sons
Paterson & Son
Raimes & Co.
J. Richardson & Co.
Raimes, Blanshards, & Co.
J. Reddish & Co.
Sanger & Sons
Savory & Moore.
W. Sutton & Co.
R. Sumner & Co.
James Sim & Co,
Sang & Barker
Southall, Bros., & Co.
W. Smeeton
Slinger & Barnett
P. Sandeman & Co.
Tidman & Son
Taylor, Gibson, & Co.
Thacker & Hoffe
Jas. Taylor
J. Woolley, Sons, & Co
Wyleys & Co.
Wilson & Kitchen
C. H. Warner & Co.
A. & J. Warren
Walkington & Son
Wright, Layman, & Umney

MILTON CHEMICAL WORKS,
STOKE-ON-TRENT,
STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Galvanising Salts, Coal-Tar, Pitch Creosote, Grease, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracen and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

FACTORIES:
Reddish and Bradford,
MANCHESTER.

CHARLES LOWE & CO.,
(Established 1860.)

TOWN OFFICES:
61, Piccadilly,
MANCHESTER.

MANUFACTURERS OF

Pure Carbolic Acid, Cryst. at 42°·2 C. } Discovered by C. Lowe.		Carbolic Acid Glycerine Solutions.	Benzol (Cryst.).
,, ,,	do. Hydrate of	Cresylic Acid.	Anthracene.
Medicinal	do. Cryst. at 35° C.	Sulpho-Phenic Acid (Cryst.	Naphthaline.
Commercial	do. No. 1 ,, 35° C.	Sulpho-Phenates & Sulpho-Cresylates of Soda, Potash, Zinc, Iron, and Alumina.	Picric Acid (Crystal and Paste).
,,	do. 2 ,, 29° C.		Aurine (Rosolic Acid Cake and Solution.
,,	do. 3 ,, 12° C.		
,,	do. 4 liquid at 0° C.		
Carbolic Acid Disinfecting Powder.			

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,
OLDBURY, NEAR BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purpose Anthracene, Naphthaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF,
STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY
RUNCORN.

London: Printed and Published for the Proprietor by Edwin John Davey, at the Office, Boy Court Ludgate Hill, E.C
March 29, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S. (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") *Established Twenty-six Years.*

Vol. 37.—No. 958. *Copyright reserved.* Friday, April 5, 1878. *Registered as a Newspaper.* Price, 4*d*. Post Free, 4½*d*.

CONTENTS.

ARTICLES:— PAGE
Short Reports from the Chemical Laboratory of Trinity College, Dublin, by J. Emerson Reynolds, M.D. 135
The Atomic Weight of Gallium 138
On the Sulphates of the Vanadium Pentoxide, by Dr. B. W. Gerland 138
PROCEEDINGS OF SOCIETIES:—
CHEMICAL SOCIETY.—Anniversary Meeting 139
PHYSICAL SOCIETY.—Byrne's Pneumatic Battery 140
CORRESPONDENCE.—Chemists and Chemists—The Chemical Society 141
CHEMICAL NOTICES FROM FOREIGN SOURCES 142
MEETINGS FOR THE WEEK 143

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

PARTNERSHIP.

An Analytical Chemist, F.C.S., wishes to obtain a working Partnership by investing a sum of money in the business of a well-established laboratory; London preferred.—Apply, A. N. Z., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

An Analytical Chemist (30), of considerable experience in works and private laboratories, is open for an Engagement as Chemist or Sub-manager: first class testimonials.—Address, Chemist, care of Messrs. Porteous and Co., Exchange Place, Glasgow.

Wanted to Purchase—a Second-hand Rolling-Mill for Assaying.—Address, stating terms and giving description, M. M. P. Muir, Caius College, Cambridge.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street, Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

Sixth Edition Illustrated.
Post 8vo., Price 15s.

ATTFIELD'S CHEMISTRY,
GENERAL, MEDICAL, AND PHARMACEUTICAL.

"For all the numerous class of students who are preparing for the medical or for the pharmaceutical profession, we know of no work in the language which can be compared with the one before us."—*Chemical News.*

"Written with a just appreciation of the small amount of time for the study of chemistry at the disposal of the student in medicine and pharmacy.—*Nature.*

JOHN VAN VOORST, 1, PATERNOSTER ROW.

The Seventh Edition, specially arranged for American Students, is published by Lea, Philadelphia.

An Analytical Chemist (age 23), with several years' experience in the laboratories of English and Scotch Universities, seeks an Engagement as Chemist in a Sugar Refinery, Works, or Assistant in a Laboratory.—Address, Chemicus, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

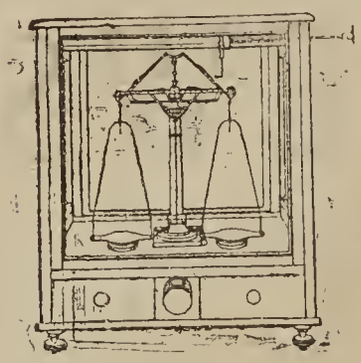
Analytical Chemist wanted, about 24 years of age, in the Laboratory of a London Sugar Refinery. State previous experience and salary required.—Address, with testimonials, Saccharine, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

To be Sold Cheap, with or without the Machinery attached, being part of the Plant of a Brewers' Saccharine Manufacturer. A Fur Vat, 10 ft. 6 in. by 5 ft. 3 in. diam., with spindle, 6-6×4½ in., worked as agitator, by small horizontal engine attached; an oak do., 6-6×6; do. do., 8×8-6, with double barrel force-pump attached; a fur do., 10×5-6; also a cast-iron geometrical staircase, 25 tread, with hand-rail.—John Mogge, 226, Cable Street, St. George's East.

To be Sold, by Private Contract, an excellent and old-established Chemical Manufacturing and Drysalting Business, together with extensive works at Manchester, Glasgow, and Ayr. The business is a very lucrative one, and is in full working order. The sole reason for selling is the death of the last surviving partner. Only principals or their solicitors will be treated with.—Apply to Slater, Heelis, and Co., Solicitors, 75, Princes Street Manchester.

MACTEAR'S PATENT CARBONATING FURNACE,
AND
JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,
MANUFACTURED BY
R. DAGLISH & CO.,
ST. HELEN'S ENGINE AND BOILER WORKS,
LANCASHIRE.

Prices and other particulars on application.



L. OERTLING,

TURNMILL STREET

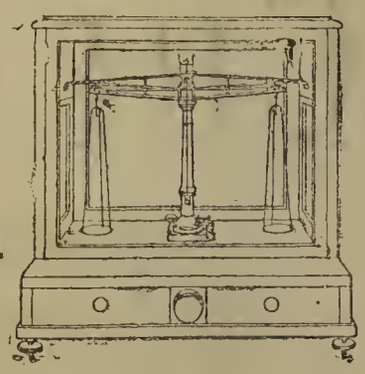
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal- Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA.

DO YOUR OWN PRINTING.

The "Optimus" Printing-Press for Amateurs. Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A HERBERT Printing Warehouse, 50, Finsbury Square, London, E.C

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS LIQUOR AMMONIA, &c.

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

BISULPHITE OF LIME.

BISULPHITE OF SODA.

WILLIAM MARRIOTT

CHEMICAL WORKS HUDDERSFIELD

F. Chemiker, Techniker, Fabrik., Ingenieure, Apotheker, Aerzte, Landwirthe. Chemisches Central-Annoncenblatt. Erscheint wöchentl. Durch j. Postanst. u. Buchhdl. zu beziehen. Preis viertelj. 2,50 M., durch Streifb. 3 M., nach dem Auslande 4,00 M. ANZEIGEN: 30 Pf. p. Zeile. Probenummern kostenfrei!

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

---

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

A. BOAKE & CO.,

STRATFORD, LONDON, E.,

MAKERS OF

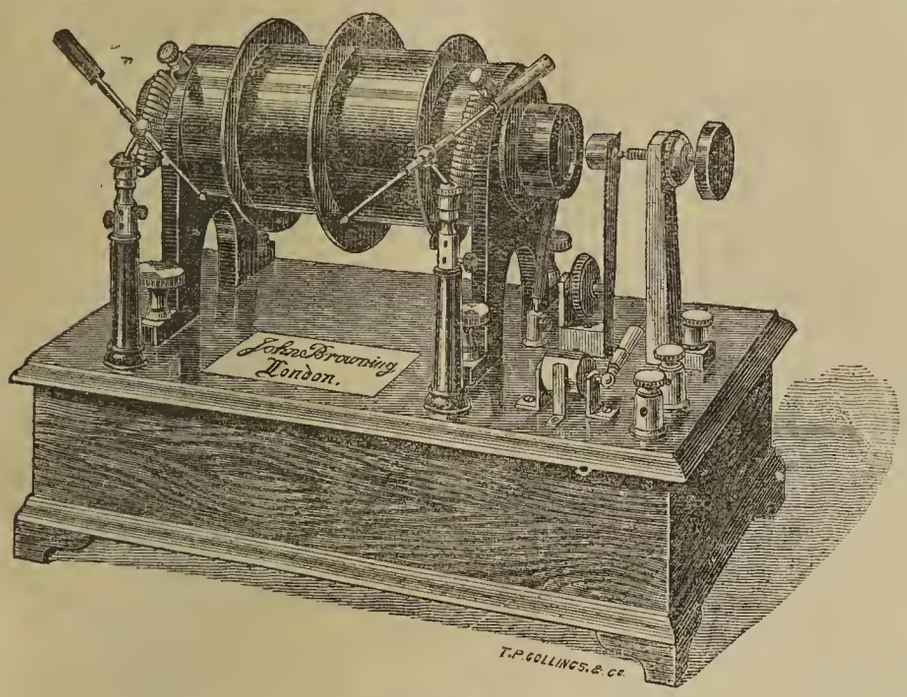
THE SULPHITES AND BISULPHITES

OF

SODA AND LIME.

BROWNING'S INDUCTION COILS.

MR. JOHN BROWNING begs to inform scientific gentlemen that the adoption of an improved method of winding Induction Coils has enabled him to increase their efficiency and reduce their cost. Every Coil is guaranteed to give the length of spark named.



	£	s.	d.
Induction Coil, to give a ½ in. spark in dry air	3	5	0
Induction Coil, to give a 1 in. spark	5	10	0
Induction Coil, to give a 1½ in. spark	6	15	0
Induction Coil, to give a 2½ in. spark	10	0	0
Induction Coil, to give a 3½ in. spark	12	15	0
Induction Coil, to give a 4½ in. spark	16	0	0
Induction Coil, to give a 6 in. spark	22	0	0

List of Electric Lamps and Lanterns sent free.

JUST PUBLISHED,

"HOW TO WORK WITH THE SPECTROSCOPE."

A Manual of Practical Manipulation with Spectroscopes of all kinds,

INCLUDING

Direct Vision	Spectroscopes.
Chemical	Spectroscopes.
Solar	Spectroscopes.
Star	Spectroscopes.
Automatic	Spectroscopes.
Bessemer	Spectroscopes.
Micro	Spectroscopes.
Screen	Spectroscopeo.

And Accessory Apparatus.

WITH ABOVE THIRTY ENGRAVINGS AND DIAGRAMS. By JOHN BROWNING, F.R.A.S., M.R.I., &c., &c.

PRICE ONE SHILLING AND SIXPENCE.

JOHN BROWNING.

Optical and Physical Instrument Maker to H.M. Government, the Royal Society, the Royal Observatories of Greenwich and Edinburgh, and the Observatories of Kew, Cambridge, Durham, Utrecht, Melbourne, &c., &c.

63, STRAND, W.C.

FACTORY—SOUTHAMPTON STREET, LONDON, W.C.

Chemical Apparatus & Scientific Instruments,

PORCELAIN, GLASS, STONE, WOOD, AND METAL APPARATUS

FOR

CHEMICAL AND PHILOSOPHICAL PURPOSES AND LECTURES.

ELECTRICAL, MEDICAL, AND EXPERIMENTAL COILS AND APPARATUS.

BUNSEN'S MODIFIED FILTER PUMPS, from 10s. 8d. to 67s.

ELECTRICAL BATTERIES AND ELEMENTS.

Sets of Apparatus according to Professor Valentin's "Book of Chemistry," and Professor Attfield's "Manual of Chemistry."

Also Sets of Apparatus as required by the Government Schools always ready and kept in stock.

Catalogues and Illustrations will be sent Gratuitously. A Liberal Discount allowed to Wholesale Buyers.

WHOLESALE IMPORTERS AND MANUFACTURERS:

AUG. BEL & CO.,

34, Maiden Lane, Strand, London, W.C.

SOLE AGENTS FOR GRENET'S BATTERIES AND NODOT'S MICROSCOPES.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing are Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for udents, Schools, Colleges, &c.

NEW PATTERNS OF GEOLOGICAL HAMMERS.

EW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
88, CHARLOTTE STREET, FITZROY SQUARE.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

CARBIDE OF IRON (made by heating iron oxide and charcoal together) for filtering water commercially.—Send price per cwt. to E. May, 30, Haverstock Street, City Road London.

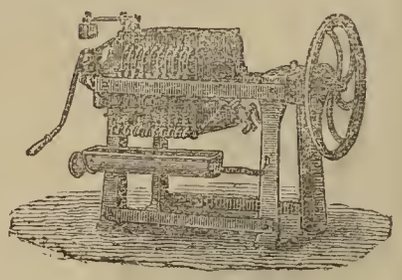
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

THE speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE	Lump, Crystallised, Ground, and Prepar Large stock of every description. *** *Suitable for all Trades.*
ARSENIC	Refined powdered, Lump, Grey, and Ruby.
FLUOR-SPAR	Finest produced. Medium and Common for al purposes.
BARYTES	Carbonate and Sulphate. All qualities of Lump and Ground.
BAUXITE	Of high percentage of Alumina and low in Iron:

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

H. M. CAPNER,

Electrical and Philosophical Instrument Maker to the Trade only.

20, NORTHAMPTON SQUARE, LONDON E.C

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.

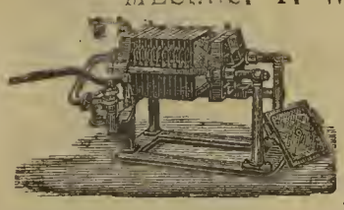
SULPHATE OF AMMONIA, ANTHRACENE BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

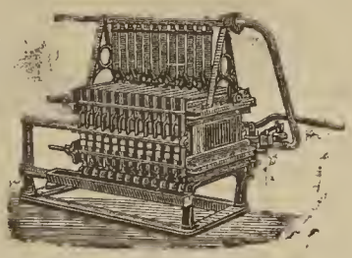
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.
And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Coal-Tar, Pitch, Creosote, Grease, Sulphate of Ammonia, Pyroligneous Acid, Acetate of Lime, Wood Naphtha, Charcoal, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

J. I. HEADLY, ENGINEER, Cambridge,
Maker of Steam Engines, Bone Mills, and other Machinery or Chemical Works; also Whole and Ground Coprolite.

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Sole Agents for Prof. Wanklyn's Test Solutions or Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM
FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA
FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

Manufactured by the
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.
Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

DOULTON & WATTS

HIGH STREET, LAMBETH, LONDON, S.E.

DEPOTS:—GRANVILLE WHARF, WOOD STREET, BIRMINGHAM; 100, SOHO STREET LIVERPOOL; AND 18, RUE MARTEL, PARIS.

MANUFACTURERS OF

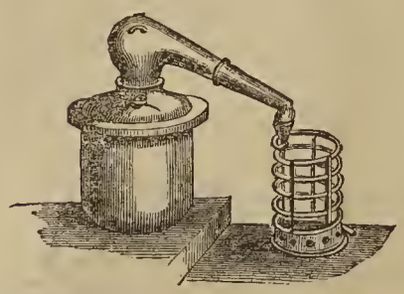
STILLS, RETORTS, CONDENSING WORMS, WOLLF'S BOTTLES

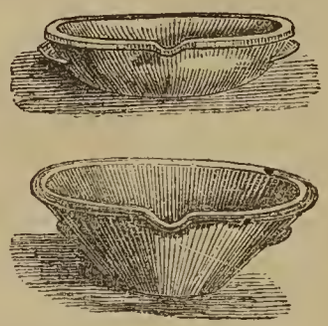
ACID PUMPS, COCKS, PERCOLATORS, AIR-TIGHT JARS,

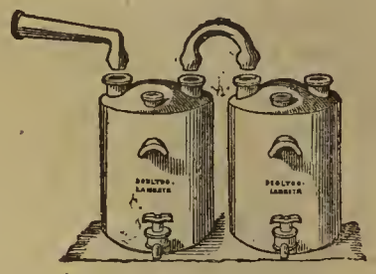
AND EVERY DESCRIPTION OF

STONEWARE FOR CHEMICAL PURPOSES,

Warranted to Resist the Strongest Acids.







PLUMBAGO CRUCIBLES, AND OTHER FIRE-STANDING GOODS.

CHEMISTS' AND DRUGGISTS' GLASS. PORCELAIN TAPS.

PRICE LISTS of any of the above, and of Every Description of Stoneware, may be had on application, and Samples seen at

Messrs. D. and W.'s SHOW ROOMS, HIGH STREET, LAMBETH.

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

MANUFACTURERS OF

PURE CARBOLIC ACID, Cryst. at 42°·2 C. } Discovered by C. Lowe.
,, ,, do. Hydrate of }
MEDICINAL do. Cryst. at 35° C.
COMMERCIAL do. No. 1 ,, 35° C.
,, do. 2 ,, 29° C.
,, do. 3 ,, 12° C.
,, do. 4 liquid at 0° C.
CARBOLIC ACID DISINFECTING POWDER.

CARBOLIC ACID GLYCERINE SOLUTIONS.
CRESYLIC ACID.
SULPHO-PHENIC ACID (CRYST.
SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.

BENZOL (Cryst.).
ANTHRACENE.
NAPHTHALINE.
PICRIC ACID (Crystal and Paste).
AURINE (Rosolic Acid Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,

OLDBURY, NEAR BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purpose Anthracene, Naphthaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF, STONEWARE MANUFACTURER, { Late JOHN CLIFF & Co. Formerly STEPHEN GREEN. } No. IMPERIAL POTTERIES, LAMBETH. OLD QUAY RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate Hill, E.C
Apr 5, 1878.

PHARMACEUTICAL SOCIETY OF GREAT BRITAIN

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [*Established Twenty-six Years.*

Vol. 37.—No. 959.] *Copyright reserved.* Friday, April 12, 1878. *Registered as a Newspaper.* [PRICE, 4*d.* POST FREE, 4½*d.*

CONTENTS.

ARTICLES:— PAGE
On Dyer's Chemicals, by J. Marzell 145
On the Loss of Nitre in the Manufacture of Sulphuric Acid, by Edward Jackson 147
Application of Organic Acids to the Examination of Minerals, by H. Carrington Bolton, Ph.D..... 148
Composition and Quality of the Metropolitan Water..... 154
PROCEEDINGS OF SOCIETIES:—
CHEMICAL SOCIETY.—Application of the Microscope to some Special Branches of Chemistry 150
CORRESPONDENCE.—The Application of Sonstadt's Solution to the Separation of Minerals for Chemical Analysis—Mineral Growth..... 152
CHEMICAL NOTICES FROM FOREIGN SOURCES..... 152
NOTES AND QUERIES.—Yolk of Eggs.—Manufacture of the Salts of Ammonia 154

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

An Analytical Chemist (age 23), with several years' experience in the laboratories of English and Scotch Universities, seeks an Engagement as Chemist in a Sugar Refinery, Works, or Assistant in a Laboratory.—Address, Chemicus, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

To Manufacturers.—Advertiser, with Sixteen Years experience in Chemical and Mechanical Factory Management, and thorough knowledge of men, desires engagement as Manager, Sub-manager, or otherwise. Unexceptionable testimonials.—Chemical Engineer, 14, Charles Street, Camberwell New Road, London.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,

TIPTON, STAFFORDSHIRE.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street, Glasgow.

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.

SECOND EDITION.

Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:

ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.

Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.

Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

THE APPLICATIONS & PROCESSES OF CHEMISTRY IN THE USEFUL ARTS.

In One Volume, medium 8vo. pp. 1000, with 698 Woodcuts, price 42s. cloth,

INDUSTRIAL CHEMISTRY, a Manual for Use in Technical Colleges or Schools, also for Manufacturers and others, based upon a Translation (partly by Dr. T. D. BARRY) of STOHMANN and HENGLER'S German Edition of PAYEN'S *Precis de Chimie Industrielle.* Edited throughout and supplemented with Chapters on the Chemistry of the Metals, &c. By B. H. PAUL, Ph.D

London: LONGMANS & CO.

Just published, price 2s. 6d.

THE LONDON WATER SUPPLY. By CHARLES MEYMOTT TIDY, M.B., Professor of Chemistry at the London Hospital.

London: J. and A. CHURCHILL.

Now ready, Seventh Edition, with 98 Engravings, fcap. 8vo, 6s. 6d.

Practical Chemistry, including Analysis.

By JOHN E. BOWMAN.

Edited by CHARLES L. BLOXAM.

Professor of Chemistry in King's College, London.

*** In this edition the systematic course of Qualitative Analysis is arranged in a tabular form, and symbols and equations are largely used throughout the work.

J. & A. CHURCHILL, New Burlington-street.

MACTEAR'S PATENT CARBONATING FURNACE,

AND

JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,

MANUFACTURED BY

R. DAGLISH & CO.,

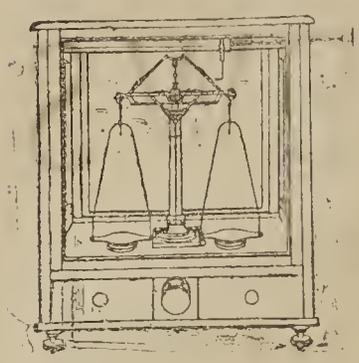
ST. HELEN'S ENGINE AND BOILER WORKS,

LANCASHIRE.

Prices and other particulars on application.

NOTICE TO ADVERTISERS.

In consequence of GOOD FRIDAY occurring in the ensuing week, the CHEMICAL NEWS *will be published on Thursday next, April the 18th. Advertisements must therefore be forwarded to the Office not later than 2 o'clock on Wednesday, the 17th instant.*



L. OERTLING,

TURNMILL STREET

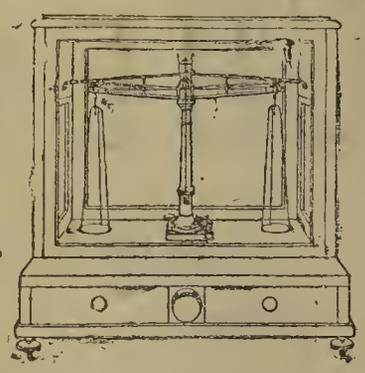
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

MILTON CHEMICAL WORKS, STOKE-ON-TRENT, STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays.. ..	£2	2 0
200 Specimens, in Cabinet, with 5 Trays.. ..	5	5 0
300 Specimens, in Cabinet, with 9 Drawers ..	10	10 0
400 Specimens, in Cabinet, with 13 Drawers ..	21	0 0

More extensive Collections at 50 to 5000 Guineas each.

EARP & CHASTER, RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS LIQUOR AMMONIA, &c.

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

F. Chemiker, Techniker, Fabrik., Ingenieure, Apotheker, Aerzte, Landwirthe. Chemisches Central-Annoncenblatt. Erscheint wöchentl. Durch j. Postanst. u. Buchhdl. zu beziehen. Preis viertelj. 2,50 M., durch Streifb. 3 M., nach dem Auslande 4,00 M. ANZEIGEN: 30 Pf. p. Zeile. Probenummern kostenfrei!

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

CALVERT'S CARBOLIC ACID.

HIGHEST PRIZE MEDAL AT PARIS EXHIBITION, 1867.

GOLD AND SILVER MEDALS, HAVRE, 1868. DIPLOME D'EXCELLENCE, AMSTERDAM SILVER MEDAL, FIRST CLASS, NAPLES, 1871. GOLD MEDAL, MOSCOW, 1872.

F. C. CALVERT & CO., of Bradford, Manchester (original and only Manufacturers of pure Medical Carbolic Acid), beg to inform the Trade and large Consumers that their pure Medical Carbolic as well as cheaper qualities for Commercial, Veterinary, and Disinfecting Purposes, also Carbolic Acid Soaps for Medical, Toilet, and General Use, Soft Soap fo Dogs, and Carbolic Acid Disinfecting Powder, may be had from any of the below-named Wholesale Agents—

Apothecaries' Soc., Lond'n	Clarke, Bleasdale, & Co.	Hodgkinsons, Preston, & King	W. Mather	James Sim & Co,
Apothecaries' Co , Glasg'w	Clay, Dod, & Case	Hearon, Squire, & Francis	McMaster, Hodgson, & Co.	Sang & Barker
Apothecaries' Hall, Dublin	Dakin Brothers	Hopkin & Williams	J. F. Macfarlan & Co.	Southall, Bros., & Co.
Allen & Hanburys	Davy, Yates, & Co.	Howards & Sons	J. Mackay	W. Smeeton
J. Bell & Co.	Duncan, Flockhart, & Co.	Hirst, Brooke, & Co.	R. H. Millard & Son	Slinger & Barnett
Barron, Harveys, & Co.	W. Edwards & Son	W. R. Hatrick & Co.	Mackey, Sellers, & Co.	P. Sandeman & Co.
Barclay & Sons.	Evans, Lescher, & Evans	P. Harris & Co.	Mottershead & Co.	Tidman & Son
Burgoyne & Co.	Evans, Sons, & Co.	Hunt & Co.	Newbery & Sons	Taylor, Gibson, & Co.
Baiss Brothers & Co.	Evans, Gadd, & Co.	J. Ismay	Paterson & Son	Thacker & Hoffe
Barron, Squire, & Co.	Ferris & Co.	Johnson & Sons	Raimes & Co.	Jas. Taylor
Battley & Watts	Glasgow New Apoth. Co.	Langtons, Edden, & Hicks	J. Richardson & Co.	J. Woolley, Sons, & Co
Bewley & Draper	General Apothecaries' Co.	Lynch & Co.	Raimes, Blanshards, & Co.	Wyleys & Co.
H. B. Brady	W. & H. M. Goulding	Lofthouse & Saltmer	J Reddish & Co.	Wilson & Kitchen
Bainbridge & Pound	Goodall, Backhouse, & Co.	Chas. Leslie	Sanger & Sons	C. H. Warner & Co.
Boileau & Boyd	Grimwade, Ridley, & Co.	Maw, Son, & Thompson	Savory & Moore.	A. & J. Warren
Curling & Co.	Hodgkinsons, Stead, & Co	H. C. Mason	W. Sutton & Co.	Walkington & Son
Corbyn & Co.	Herrings & Co.		R. Sumner & Co.	Wright, Layman, & Umne

THE QUARTERLY JOURNAL OF SCIENCE.

Edited by WILLIAM CROOKES, F.R.S., &c

Now ready No. LVIII., *April*, 1878, price 5s.

CONTENTS.

I. Economy of Nitrogen.
II. On the Movements of Microscopic Particles Suspended in Liquids. By Prof. W. Stanley Jevons, LL.D., M.A., F.R.S.
III. Energy and Feeling: Alternate and Mutually Convertible Affections of Matter. By W. S. Duncan.
IV. The Gold and Placer Mines of Wicklow. By G. H. Kinahan, M.R.I.A., &c.
V. On the Relation of Moisture in Air to Health and Comfort. By Robt. Briggs, C.E.
VI. On Space of Four Dimensions, Illustrating the Phenomena ascribed to Spiritualism. By Prof J. C. Friedrich Zöllner, Leipzic. (With Page Lithograph.)
VII. Liquefaction of Oxygen. By M. Raoul Pictet. (Illustrated.)
VIII. The Phonograph. (Illustrated.)
Notices of Scientific Works, Scientific Notes, &c.

London: 3, Horse-Shoe Court, Ludgate Hill, E.C.

Now ready, 8vo., cloth, 30s.

PHOTOGRAPHED SPECTRA. One Hundred and Thirty-six Photographs of Metallic, Gaseous, and other Spectra, printed by the permanent autotype process, with Introduction, Description of Plates, and Index; and with an extra plate of the Solar Spectrum (showing bright lines), compared with the Air Spectrum, by J. RAND CAPRON, F.R.A.S.

London: E. and F. N. SPON, 48, Charing Cross.
New York: 446, Broome Street.

Natural History and Scientific Book Circular, No. 28, March, containing a List of Works on

CHEMISTRY, PHYSICS.

Free by Post for One Stamp.
W. WESLEY, 28, Essex Street, Strand, London.

THE TELEPHONE.

Arrangements for Exhibiting or Fixing on application to EDWARD PATERSON, Telegraph Engineer, 3, Bedford Court, Covent Garden, W.C. Insulated Wires, Call-Bells, Insulators, and Galvanised Wire for Overhead Lines. Electric House-Bells, and all descriptions of Electrical Apparatus for experimental and other purposes. Price list post free 2 stamps.

To be Sold, by Private Contract, an excellent and old-established Chemical Manufacturing and Drysalting Business, together with extensive works at Manchester, Glasgow, and Ayr. The business is a very lucrative one, and is in full working order. The sole reason for selling is the death of the last surviving partner. Only principals or their solicitors will be treated with.—Apply to Slater, Heelis, and Co., Solicitors, 75, Princes Street, Manchester.

FOR SALE, British Association Reports, last 16 vols.; Ure's Dict. Arts (1861), 3 vols.; Gmelin's Handbook Chem., first 6 vols.; Watts's Dict. Chem., first 5 vols.; Bischoff's Chem. Geol., 3 vols.; Dana's System Min. (1874).—Address, K., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

THE CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

heques and Post-Office Orders, crossed "London and County k," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

GLASGOW CORPORATION GAS.

RESIDUAL PRODUCT WORKS TO LET, AND RESIDUAL PRODUCTS FOR SALE.

The Glasgow Corporation Gas Commissioners are prepared to receive Offers for a Lease of their Residual Product Works at Dawsholm, near Maryhill, and also for the purchase of the Tar and Ammoniacal Liquor produced at their Gas Works there. The Lease to be for such term of years, from 1st June, 1878, as may be agreed on. Offerers must offer a fixed Rent of £1200 per annum, and also a further sum in respect of each Ton of Coal carbonised at the Dawsholm Gas Works. On application at the Gas Office (Manager's Department), 42, Virginia Street, intending Offerers will receive Orders for inspecting the Works. The Conditions of Let and Sale may be seen, and Forms of Offer obtained on application of the Subscriber, and Offers will be received by him up till Monday, the 22nd current.

The Commissioners do not undertake to accept the highest or any Offer.

J. D. MARWICK,
Clerk to the Commissioners.

City Chambers, Glasgow, April 2, 1878.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester.

Sulpho-cyanide of Calcium, containing about 26 to 28, for Sale.—Address, Alpha, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N E Also FINISH, FUSEL OIL and RECT. NAPHTHA

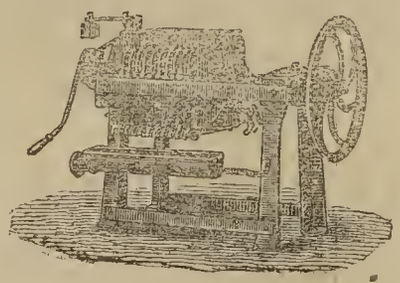
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

The speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction to Suit Special Requirements.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE	Lump, Crystallised, Ground, and Prepar Large stock of every description. *** *Suitable for all Trades.*
ARSENIC	Refined powdered, Lump, Grey, and Ruby.
FLUOR-SPAR	Finest produced. Medium and Common for al purposes.
BARYTES	Carbonate and Sulphate. All qualities of Lump and Ground.
BAUXITE	Of high percentage of Alumina and low in Iron;

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,
MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—Special attention is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing are Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for udents, Schools, Colleges, &c.

NEW PATTERNS OF GEOLOGICAL HAMMERS.
EW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
88, CHARLOTTE STREET, FITZROY SQUARE.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

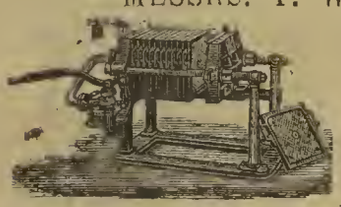
POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

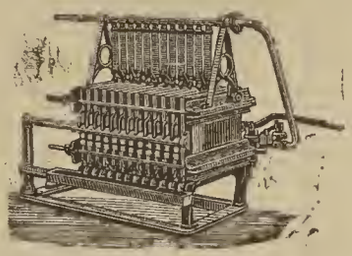
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Coal-Tar, Pitch, Creosote, Grease, Sulphate of Ammonia, Pyroligneous Acid, Acetate of Lime, Wood Naphtha, Charcoal, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

J. I. HEADLY, ENGINEER, Cambridge, Maker of Steam Engines, Bone Mills, and other Machinery r Chemical Works; also Whole and Ground Coprolite.

TOWNSON & MERCER
(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Sole Agents or Prof. Wanklyn's Test Solutions or Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

FOR DYEING AND CALICO PRINTING.

VANADIUM.
OXIDE AND SULPHIDES OF VANADIUM FOR ANILINE BLACK.
CHLORIDE OF VANADIUM AND VANADIATE AMMONIA FOR CATECHU BROWN.

CHLORATE OF SODA.
IN CRYSTALS, COMMERCIALLY PURE.

HYDROCHLORATE OF ANILINE IN CRYSTALS.

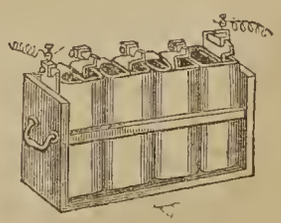
Manufactured by the
MAGNESIUM METAL COMPANY
PATRICROFT, NEAR MANCHESTER.
Also Sodium, Chemically Pure Soda from Sodium, Potassium, Magnesium, &c.

TAR DISTILLERS
BOUCK & Co LIMITED
DRYSALTERS
1862 LONDINI HONORIS CAUSA
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp. Zinc. Nitric Acids &c. &c.
BRIMSTONE REFINERS
Samples & prices on application.
J. I. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID, PICRIC ACID, Sal-Acetosella BICHROME CHLORATE OF POTASH, &c. &c. BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

CHEMICAL & SCIENTIFIC APPARATUS,

WHOLESALE AND RETAIL.

EVERY DESCRIPTION OF APPARATUS FOR STUDY, LECTURES, OR RESEARCH.



Country Orders, accompanied by a remittance, executed same day as received; and carriage paid in England and Wales if over £2 in value.

PRICE LISTS POST FREE ON APPLICATION.

M. JACKSON AND CO.,

65, BARBICAN, LONDON.

FACTORIES: Reddish and Bradfoid, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

MANUFACTURERS OF

PURE CARBOLIC ACID, Cryst. at 42°·2 C. } Discovered by C. Lowe.
,, ,, do. Hydrate of
MEDICINAL do. Cryst. at 35° C.
COMMERCIAL do. No. 1 ,, 35° C.
,, do. 2 ,, 29° C.
,, do. 3 ,, 12° C.
,, do. 4 liquid at 0° C.
CARBOLIC ACID DISINFECTING POWDER.

CARBOLIC ACID GLYCERINE SOLUTIONS.
CRESYLIC ACID.
SULPHO-PHENIC ACID (CRYST.
SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.

BENZOL (Cryst.).
ANTHRACENE.
NAPHTHALINE.
PICRIC ACID (Crysta and Paste).
AURINE (Rosolic Acid Cake and Solution

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

Silver Prize Medal, Paris Exhibition, 1867.

COAL-TAR PRODUCTS.

LEWIS DEMUTH & CO.,

OLDBURY, NEAR BIRMINGHAM

Benzole, Toluole, Burning and Solvent Naphtha, Carbolic Acid for Disinfecting, Commercial, and Medicinal Purpose Anthracene, Naphtnaline, Varnishes, Lubricating and Burning Oils, Grease, Pitch, Creosote, &c.

JOHN CLIFF,

STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
No. IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY
RUNCORN.

London Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court Ludgate Hill, E.C
April 12, 1878.

PHARMACEUTICAL SOCIETY OF GREAT BRITAIN

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [*Established Twenty-six Years.*

Vol. 37.—No. 960.] *Copyright reserved.* Thursday, April 18, 1878. *Registered as a Newspaper.* [PRICE, 4*d.* POST FREE, 4½*d.*

CONTENTS.

ARTICLES:— PAGE
Nitric Acid in the Vitriol Manufacture, by George E. Davis 155
Action of Perchloride of Iron and Concentrated Sulphuric Acid on some of the Bases in Opium, by David Lindo..... 158
The New Method of Weighing Precipitates, by Charles W. Folkard..... 158
PROCEEDINGS OF SOCIETIES:—
PHYSICAL SOCIETY 158
NOTICES OF BOOKS.—A Treatise on Photography—Mineralogy—Science for All 159
CORRESPONDENCE.—The Application of Sonstadt's Solution to the Separation of Minerals for Chemical Analysis—Weighing Precipitates 160
CHEMICAL NOTICES FROM FOREIGN SOURCES..... 161
MEETINGS FOR THE WEEK 163

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

An Analytical Chemist (age 23), with several years' experience in the laboratories of English and Scotch Universities, seeks an Engagement as Chemist in a Sugar Refinery, Works, or Assistant in a Laboratory.—Address, Chemicus, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

To be Sold, by Private Contract, an excellent and old-established Chemical Manufacturing and Drysalting Business, together with extensive works at Manchester, Glasgow, and Ayr. The business is a very lucrative one, and is in full working order. The sole reason for selling is the death of the last surviving partner. Only principals or their solicitors will be treated with.—Apply to Slater, Heelis, and Co., Solicitors, 75, Princes Street, Manchester.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street, Glasgow,

NOW READY,

GRIFFIN'S CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

THE APPLICATIONS & PROCESSES OF CHEMISTRY IN THE USEFUL ARTS.

In One Volume, medium 8vo. pp. 1000, with 698 Woodcuts, price 42s. cloth,

INDUSTRIAL CHEMISTRY, a Manual for Use in Technical Colleges or Schools, also for Manufacturers and others, based upon a Translation (partly by Dr. T. D. BARRY) of STOHMANN and HENGLER'S German Edition of PAYEN'S *Precis de Chimie Industrielle*. Edited throughout and supplemented with Chapters on the Chemistry of the Metals, &c. By B. H. PAUL, Ph.D

London: LONGMANS & CO.

Now ready, Seventh Edition, with 98 Engravings, fcap. 8vo, 6s. 6d.

Practical Chemistry, including Analysis.
By JOHN E. BOWMAN.
Edited by CHARLES L. BLOXAM.
Professor of Chemistry in King's College, London.

*** In this edition the systematic course of Qualitative Analysis is arranged in a tabular form, and symbols and equations are largely used throughout the work.

J. & A. CHURCHILL, New Burlington-street.

DESTRUCTIVE DISTILLATION: A Manualette of the Paraffin, Coal-Tar, Rosin Oil, Petroleum, and Kindred Industries. By EDMUND J. MILLS, D.Sc. (Lond.), F.R.S., "Young" Professor of Technical Chemistry in Anderson's College, Glasgow.

"Will be found useful by both students and manufacturers."—*English Mechanic.*

"We may conclude by strongly recommending this manualette to all our readers who may desire to obtain information on the subject of which it treats."—*Journal of Gas Lighting.*

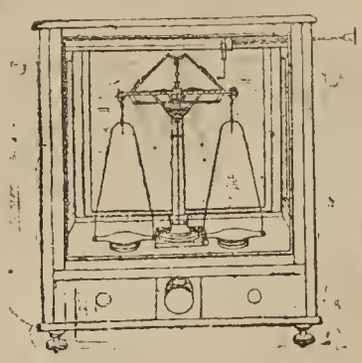
London: VAN VOORST.

MACTEAR'S PATENT CARBONATING FURNACE,
AND
JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,
MANUFACTURED BY
R. DAGLISH & CO.,
ST. HELEN'S ENGINE AND BOILER WORKS,
LANCASHIRE.

Prices and other particulars on application.

Wanted, to Purchase, a Small Analytical Practice. Principals only dealt with.—Address, N. R. E. CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Sulpho-cyanide of Calcium, containing about 26 to 28 per cent, for Sale.—Address, Alpha, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.



L. OERTLING,

TURNMILL STREET

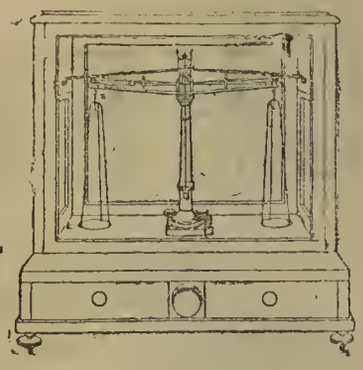
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal- Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

MILTON CHEMICAL WORKS, STOKE-ON-TRENT, STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays.. ..	£2	2	0
200 Specimens, in Cabinet, with 5 Trays.. ..	5	5	0
300 Specimens, in Cabinet, with 9 Drawers ..	10	10	0
400 Specimens, in Cabinet, with 13 Drawers ..	21	0	0

More extensive Collections at 50 to 5000 Guineas each.

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS LIQUOR AMMONIA, &c.

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes, supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

F. Chemiker, Techniker, Fabrik., Ingenieure, Apotheker, Aerzte, Landwirthe. Chemisches Central-Annoncenblatt. Erscheint wöchentl. Durch j. Postanst. u. Buchhdl. zu beziehen. Preis viertelj. 2,50 M., durch Streifb. 3 M., nach dem Auslande 4,00 M. ANZEIGEN: 30 Pf. p. Zeile. Probenummern kostenfrei!

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

A. BOAKE & CO.,

STRATFORD, LONDON, E.,

MAKERS OF

THE SULPHITES AND BISULPHITES

OF

SODA AND LIME.

CHEMISTS AND MANUFACTURERS

Are solicited, before purchasing FILTER-PRESSES, to examine the merits of

JOHNSON'S PATENT HYDRAULIC FILTER,

And see whether, for—

CORRECTNESS OF PRINCIPLE,
DESIGN,
CONVENIENCE AND ECONOMY IN WORKING,
SOLIDITY AND EXCELLENCE OF WORKMANSHIP,
AND LOWNESS OF PRICE,

t is not by far the BEST, CHEAPEST, and MOST RAPID MEANS OF FILTRATION IN THE MARKET, for—

SEPARATING SOLIDS FROM SEMI-FLUIDS,
FILTERING LIQUIDS BRIGHT,
WASHING PRECIPITATES,
DRYING PRECIPITATES, SLURRY OR SLUDGE.

in any quantities, large or small, with great economy in cloths, which never burst and are easily removed for cleaning when required. These are advantages which command its adoption over every other form of Filter.

Trials at the Works made Gratis in presence of Intending Purchasers.

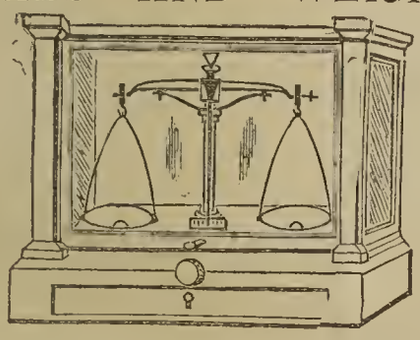
Small Filter-Press for Laboratory Use, with Pump complete ... ... from £7.

JOHNSON'S ENGINEERING WORKS,
CARPENTER'S ROAD, STRATFORD.
LONDON OFFICES - - - - - - - N. NUTTER, 71, CORNHILL, E.C.

BECKER & SONS,

MANUFACTURERS OF
CHEMICAL AND GOLD ASSAY BALANCES
AND OTHER
SCALES AND WEIGHTS.

ROTTERDAM.



NEW YORK.

BECKER'S STUDENT'S BALANCE, in polished mahogany glass case, sliding front, counterpoised, to carry 30 grammes in each pan and turn to ½ milligramme, nickel plated pans..£2 10
Ditto, ditto, in mahogany glass case, polished black £2 13

Sole Agents for England, Ireland, and Wales:—

TOWNSON & MERCER,

Becker's Complete Lists forwarded by post on receipt of 1*d.* stamp, or free on application.

JAMES WOOLLEY, SONS, & CO.

69, MARKET STREET, MANCHESTER,

DEALERS IN

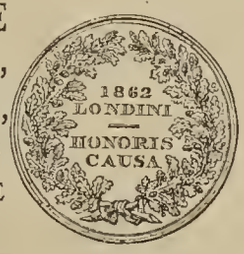
CHEMICAL AND SCIENTIFIC APPARATUS
CHEMICAL REAGENTS, &c.,

FOR THE USE OF

ANALYSTS, SCIENCE TEACHERS, AND MANUFACTURERS

Price Lists on application.

BISULPHIDE OF CARBON,



PROTOSULPHATE,
RED OXIDE
OXYCHLORIDE
Sulphocyanide,
And every other Mercurial Preparation.

BISULPHITE OF LIME, TETRACHLORIDE OF CARBON
Oxysulphuret of Antimony, Glacial Acetic Acid,

LIQUOR AMMONIÆ,
SULPHIDE OF IRON,
PURE ACIDS,
CHLORIDE OF SULPHUR,
ACETONE,
CHLOROFORM,
ALDEHYDE,
CHLORATE BARYTA,
ARSENIC ACIDS,
FRUIT ESSENCES FOR CONFECTIONERY & LIQUEURS,
PERCHLORIDE OF IRON,
SULPHITE AND HYPOSULPHITE OF SODA,
PHOSPHATES OF SODA AND AMMONIA,
ETHERS,
BROMIDES,
IODIDES,
SCALE AND GRANULAR PREPARATIONS.

ALSO,
Pure Photographic Chemicals of every kind.
MANUFACTURED BY
WILLIAM BAILEY & SON,
HORSELEY FIELDS CHEMICAL WORKS,
WOLVERHAMPTON

Methylated Spirits.—David Smith Kidd
Licensed Maker, Commercial Street, Shoreditch, N.E
Also FINISH, FUSEL OIL and RECT. NAPHTHA

THE NEW MINIATURE SPRENGEL PUMP.
(STEARN AND SWAN'S PATENT.)

As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

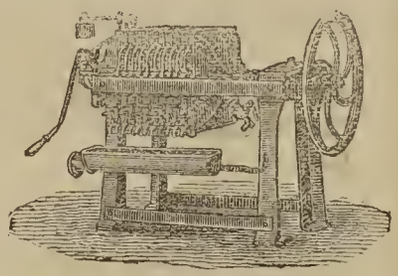
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

THE speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Matcrials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE Lump, Crystallised, Ground, and Prepar Large stock of every description.
*** *Suitable for all Trades.*

ARSENIC Refined powdered, Lump, Grey, and Ruby.

FLUOR-SPAR Fnest produced. Medium and Common for al purposes.

BARYTES Carbonate and Sulphate. All qualities of Lump and Ground.

BAUXITE Of high percentage of Alumina and low in Iron;

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,
MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing are Elements, &c., for Chemical Puposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for udents, Schools, Colleges, &c.
NEW PATTERNS OF GEOLOGICAL HAMMERS.
EW CATALOGUE OF SECOND-HAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
88, CHARLOTTE STREET, FITZROY SQUARE.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

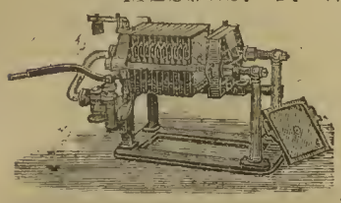
POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

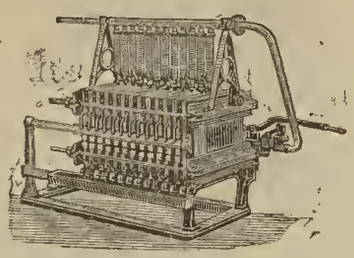
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.
And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Coal-Tar, Pitch, Creosote, Grease, Sulphate of Ammonia, Pyroligneous Acid, Acetate of Lime, Wood Naphtha, Charcoal, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

J. I. HEADLY, ENGINEER, Cambridge,
Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Sole Agents or Prof. Wanklyn's Test Solutions or Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	a.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series of insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

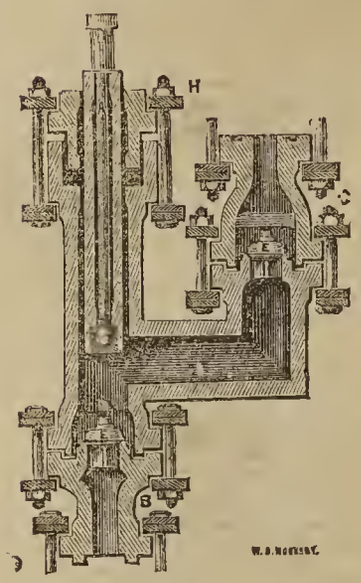
TAR DISTILLERS
DRYSALTERS
BOUCK & Co LIMITED
MILES PLATTING, MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp Zinc Nitric Acids &c &c.
BRIMSTONE REFINERS
Samples & prices on application.
J. I. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID, PICRIC ACID, Sal-Acetosella BICHROME CHLORATE OF POTASH, &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

DOULTON & WATTS

HIGH STREET, LAMBETH, LONDON, S.E.

MANUFACTURERS OF

STONEWARE ACID PUMPS AND COCKS,



STILLS, RETORTS, CONDENSING WORMS

WOLFF'S BOTTLES

PERCOLATORS, AIR-TIGHT JARS,

And every description of Stoneware or Chemical Purposes, warranted to resist the strongest acids.

PLUMBAGO CRUCIBLES AND OTHER FIRE-STANDING GOODS.

CHEMISTS' & DRUGGISTS' GLASS. PORCELAIN TAPS

Price Lists of any of the above, and of every description of Stoneware, may be had on application.

Messrs. D. and W. were awarded a MEDAL for ACID PUMPS, and also one for PLUMBAGO CRUCIBLES, at the Vienna Exhibition, 1873.

Head Offices and Show Rooms, HIGH STREET, LAMBETH, S.E.

Depots :—Granville Wharf, Wood Street, Birmingham; 100, Soho Street, Liverpool ; Hope Street, Salford, Manchester ; and 6, Rue de Paradis Poissonière, Paris.

KRYOLITH

FROM GREENLAND.

MAYER & HENCKEL,

COPENHAGEN.

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

MANUFACTURERS OF

PURE CARBOLIC ACID, Cryst. at 42°·2 C. } Discovered by C. Lowe.	CARBOLIC ACID GLYCERINE SOLUTIONS.	BENZOL (Cryst.).
,, ,, do. Hydrate of	CRESYLIC ACID.	ANTHRACENE.
MEDICINAL do. Cryst. at 35° C.	SULPHO-PHENIC ACID (CRYST.	NAPHTHALINE.
COMMERCIAL do. No. 1 ,, 35° C.	SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.	PICRIC ACID (Crystal and Paste).
,, do. 2 ,, 29° C.		AURINE (Rosolic Acid) Cake and Solution.
,, do. 3 ,, 12° C.		
,, do. 4 liquid at 0° C.		
CARBOLIC ACID DISINFECTING POWDER.		

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

JOHN CLIFF, STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co. Formerly STEPHEN GREEN. No. 6 IMPERIAL POTTERIES, LAMBETH.

OLD QUAY RUNCORN.

London ; Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate Hill, E C
Apr. 18, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S. (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") *Established Twenty-six Years.*

Vol. 37.—No. 961. *Copyright reserved.* Friday, April 26, 1878. *Registered as a Newspaper.* PRICE, 4*d.* POST FREE, 4½*d.*

CONTENTS.

ARTICLES:— PAGE
On some Candles Altered by Long Exposure to Sea-water, by J. H. Gladstone, Ph.D., F.R.S. 165
A Gas-Absorber, by G. Gore, LL.D., F,R.S. 165
PROCEEDINGS OF SOCIETIES:—
CHEMICAL SOCIETY.—Terpin and Terpinol—Poisonous Principle of Urechites Suberecta—Temperature at which some of the Alkaloids, &c., sublime 166
NEWCASTLE-UPON-TYNE CHEMICAL SOCIETY.—President's Address 167
NOTICES OF BOOKS.—Artificial Manures—Beer; its Adulterations, and the Means for their Detection 171
CORRESPONDENCE.—Spontaneous Metal-Growth 172
CHEMICAL NOTICES FROM FOREIGN SOURCES 172

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

An Analytical Chemist (age 23), with several years' experience in the laboratories of English and Scotch Universities, seeks an Engagement as Chemist in a Sugar Refinery, Works, or Assistant in a Laboratory.—Address, Chemicus, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

To be Sold, by Private Contract, an excellent and old-established Chemical Manufacturing and Drysalting Business, together with extensive works at Manchester, Glasgow, and Ayr. The business is a very lucrative one, and is in full working order. The sole reason for selling is the death of the last surviving partner. Only principals or their solicitors will be treated with.—Apply to Slater, Heelis, and Co., Solicitors, 75, Princes Street, Manchester.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

GRIFFIN'S
CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

MACTEAR'S PATENT CARBONATING FURNACE,
AND
JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,
MANUFACTURED BY
R. DAGLISH & CO.,
ST. HELEN'S ENGINE ANL BOILER WORKS,
LANCASHIRE.
Prices and other particulars on application.

Just published, price 2s. 6d.

THE LONDON WATER SUPPLY. By CHARLES MEYMOTT TIDY, M.B., Professor of Chemistry at the London Hospital.

London: J. and A. CHURCHILL.

Wanted, to Purchase, a Small Analytical Practice. Principals only dealt with.—Address, N. R. E. CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Wanted, a Practical Manager for extensive Chemical Works on the Tyne. Must have a thorough knowledge of all the modern appliances for making soda-ash, &c. First class testimonials as to character, experience, and ability indispensable.—Apply to Box 64, Exchange, Sandhill, Newcastle-upon-Tyne.

CHEMICAL APPARATUS AND SCIENTIFIC INSTRUMENT MANUFACTURERS.

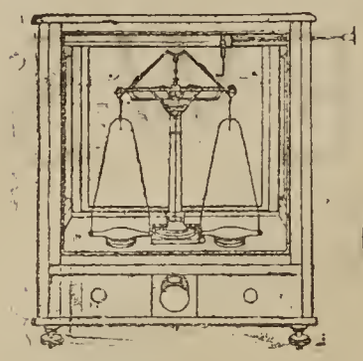
Wanted, a Partner in a Well Established Business; must have at least £2000 at command. Principals or their Solicitors only treated with.—Address, in first instance, K. Messrs. Houghtons and Byfield, Solicitors, 85, Gracechurch St., E.C

Partner wanted, in Country Tar and Ammonia Distillery; first class opening for an Active Man with £1500 capital.—Address, C. C., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

ORIGINAL RESEARCH—ANNOUNCEMENT.

The long-sought for Governing Principles of Dr. Dalton's Doctrine of Definite, Reciprocal, and Multiple Proportions have been discovered; including a complete elucidation, of the Governing Principles of the Substitution, Hydrogen-replacement, and Compound Radical Theories—Inorganic and Organic—of Modern Chemistry.

These discoveries are the result of eighteen years of Investigation and Research, and, entire success having been achieved, they are now brought forward complete in every sense of the word, and will prove an invaluable aid to the Student, the Teacher, the Lecturer, and the Practical Chemist, in every branch of the Science. Due notice of publication will be advertised.—"ERBERTMA."



L. OERTLING,

TURNMILL STREET

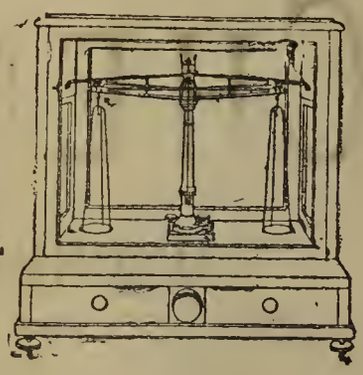
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal- Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

MILTON CHEMICAL WORKS, STOKE-ON-TRENT, STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

---

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the ollowing terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays..	..	£2	2 0
200 Specimens, in Cabinet, with 5 Trays..	..	5	5 0
300 Specimens, in Cabinet, with 9 Drawers	..	10	10 0
00 Specimens, in Cabinet, with 13 Drawers	..	21	0 0

More extensive Collections at 50 to 5000 Guineas each.

EARP & CHASTER, RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS LIQUOR AMMONIA, &c.

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

CÖTHEN.

F. Chemiker, Techniker, Fabrik., Ingenieure, Apotheker, Aerzte, Landwirthe. Chemisches Central-Annoncenblatt. Erscheint wöchentl. Durch j. Postanst. u. Buchhdl. zu beziehen. Preis viertelj. 2,50 M., durch Streifb. 3 M., nach dem Auslande 4,00 M. ANZEIGEN: 30 Pf. p. Zeile. Probenummern kostenfrei!

THOMAS ADKINS & CO., SMETHWICK,

NEAR BIRMINGHAM.

MANUFACTURERS OF SPECIALLY PREPARED RED LEAD FOR FLINT-GLASS MAKING.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

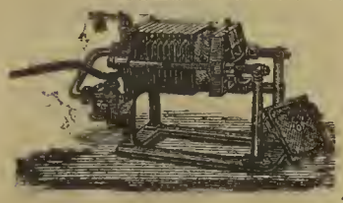
POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

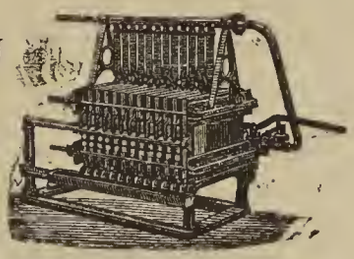
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.
And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Coal-Tar, Pitch, Creosote, Grease, Sulphate of Ammonia, Pyroligneous Acid, Acetate of Lime, Wood Naphtha, Charcoal, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

J. I. HEADLY, ENGINEER, Cambridge,
Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

TOWNSON & MERCER
(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Sole Agents for Prof. Wanklyn's Test Solutions or Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post free including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series of insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

TAR DISTILLERS
DRYSALTERS
BOUCK & Co LIMITED
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp. Zinc Nitric Acids &c. &c.
BRIMSTONE REFINERS
Samples & prices on application.
J. I. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID, PICRIC ACID, Sal-Aceto-cella BICHROME CHLORATE of POTASH, &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

CALVERT'S CARBOLIC ACID.

HIGHEST PRIZE MEDAL AT PARIS EXHIBITION, 1867.

GOLD AND SILVER MEDALS, HAVRE, 1868. DIPLOME D'EXCELLENCE, AMSTERDAM SILVER MEDAL, FIRST CLASS, NAPLES, 1871. GOLD MEDAL, MOSCOW, 1872.

F. C. CALVERT & CO., of Bradford, Manchester (original and only Manufacturers of pure Medical Carbolic Acid), beg to inform the Trade and large Consumers that their pure Medical Carbolic as well as cheaper qualities for Commercial, Veterinary, and Disinfecting Purposes, also Carbolic Acid Soaps for Medical, Toilet, and General Use, Soft Soap o Dogs, and Carbolic Acid Disinfecting Powder, may be had from any of the below-named Wholesale Agents—

Apothecaries' Soc., Lond'n	Clarke, Bleasdale, & Co.	Hodgkinsons, Preston, & King	W. Mather	James Sim & Co,
Apothecaries' Co , Glasg'w	Clay, Dod, & Case	Hearon, Squire, & Francis	McMaster, Hodgson, & Co.	Sang & Barker
Apothecaries' Hall, Dublin	Dakin Brothers	Hopkin & Williams	J. F. Macfarlan & Co.	Southall, Bros., & Co.
Allen & Hanburys	Davy, Yates, & Co.	Howards & Sons	J. Mackay	W. Smeeton
J. Bell & Co.	Duncan, Flockhart, & Co.	Hirst, Brooke, & Co.	R. H. Millard & Son	Slinger & Barnett
Barron, Harveys, & Co.	W. Edwards & Son	W. R. Hatrick & Co.	Mackey, Sellers, & Co.	P. Sandeman & Co.
Barclay & Sons.	Evans, Lescher, & Evans	P. Harris & Co.	Mottershead & Co.	Tidman & Son
Burgoyne & Co.	Evans, Sons, & Co.	Hunt & Co.	Newbery & Sons	Taylor, Gibson, & Co.
Baiss Brothers & Co.	Evans, Gadd, & Co.	J. Ismay	Paterson & Son	Thacker & Hoffe
Barron, Squire, & Co.	Ferris & Co.	Johnson & Sons	Raimes & Co.	Jas. Taylor
Battley & Watts	Glasgow New Apoth. Co.	Langtons, Edden, & Hicks	J. Richardson & Co.	J. Woolley, Sons, & Co
Bewley & Draper	General Apothecaries' Co.	Lynch & Co.	Raimes, Blanshards, & Co.	Wyleys & Co.
H. B. Brady	W. & H. M. Goulding	Lofthouse & Saltmer	J. Reddish & Co.	Wilson & Kitchen
Bainbridge & Pound	Goodall, Backhouse, & Co.	Chas. Leslie	Sanger & Sons	C. H. Warner & Co.
Boileau & Boyd	Grimwade, Ridley, & Co.	Maw, Son, & Thompson	Savory & Moore.	A. & J. Warren
Curling & Co.	Hodgkinsons, Stead, & Co.	H. C. Mason	W. Sutton & Co.	Walkington & Son
Corbyn & Co.	Herrings & Co.		R. Sumner & Co.	Wright, Layman, & Umney

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal P lytechnic Institution.

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester

ERECTION OF PLANT.

TO SULPHATE OF AMMONIA MANUFACTURERS AND OTHERS.

STILLS, SATURATORS, and all APPARATUS in connection with the above Erected upon the Most Approved Plan—result of 15 years practical experience.—Address, G. Tunbridge, Man. Chem. Dept., Gas Works, Leicester, or J. Barnes, Plumber, &c., Barking, Essex.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH. FUSEL OIL and RECT. NAPHTHA

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

KRYOLITH FROM GREENLAND.

MAYER & HENCKEL, *COPENHAGEN.*

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO., (ESTABLISHED 1860.)

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

MANUFACTURERS OF

PURE CARBOLIC ACID, Cryst. at 42°·2 C. } Discovered by C. Lowe.
,, ,, do. Hydrate of
MEDICINAL do. Cryst. at 35° C.
COMMERCIAL do. No. 1 ,, 35° C.
,, do. 2 ,, 29° C.
,, do. 3 ,, 12° C.
,, do. 4 liquid at 0° C.
CARBOLIC ACID DISINFECTING POWDER.

CARBOLIC ACID GLYCERINE SOLUTIONS.
CRESYLIC ACID.
SULPHO-PHENIC ACID (CRYST.
SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.

BENZOL (Cryst.).
ANTHRACENE.
NAPHTHALINE.
PICRIC ACID (Crystal and Paste).
AURINE (Rosolic Acid) Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesal and Export Houses.

JOHN CLIFF, STONEWARE MANUFACTURER, Late JOHN CLIFF & Co. Formerly STEPHEN GREEN. No. IMPERIAL POTTERIES, LAMBETH. OLD QUAY RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate Hill, E C
April 26, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S. (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") *Established Twenty-six Years.*

Vol. 37.—No. 962. *Copyright reserved.* Friday, May 3, 1878. *Registered as a Newspaper.* PRICE, *d.* POST FREE, 4½*d.*

CONTENTS.

ARTICLES:— PAGE
The Constitution of Malt Liquors, and their Influence upon Digestion and Nutrition, by J. J. Coleman, F.I.C., F.C.S. 177
On a New Method for the Separation and Subsequent Treatment of Precipitates in Chemical Analysis, by F. A. Gooch 181
On Some Analyses of Glass, by Sergius Kern, M.E. 183
New Form of Apparatus for Fractional Distillation under Diminished Pressure, by E. J. Bevan 183
CHEMICAL NOTICES FROM FOREIGN SOURCES 184
MISCELLANEOUS.—Serious Accident to Mr. William Baker, of Sheffield—Russian Scientific News 185
MEETINGS FOR THE WEEK 185
NOTES AND QUERIES.—Oil for Leather 185

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

A Thorough Chemist, with five years' practice in chemical works, wishes an Engagement in a works as a Sub-Manager, &c., or in the Laboratory.—J. M., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Advertiser wishes to meet with a Chemist who is willing to join him in Commencing an Analytical Practice.—Address, X. Y., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London E.C.

Wanted, to Purchase, a Small Analytical Practice. Principals only dealt with.—Address, N. R. E., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Partner wanted, in Country Tar and Ammonia Distillery; first class opening for an Active Man with £1500 capital.—Address, C. C., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

GRIFFIN'S
CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS;
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

MACTEAR'S PATENT CARBONATING FURNACE,
AND
JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,
MANUFACTURED BY
R. DAGLISH & CO.,
ST. HELEN'S ENGINE AND BOILER WORKS,
LANCASHIRE.
Prices and other particulars on application.

An Active and Energetic Agent in Hamburg, with good connections, wishes to represent some First Class Chemical Works. Undeniable references.—Address, H.H., 4, Falcon Street, Aldersgate Street, London.

Wanted, a Practical Manager for extensive Chemical Works on the Tyne. Must have a thorough knowledge of all the modern appliances for making soda-ash, &c. First class testimonials as to character, experience, and ability indispensable.—Apply to Box 64, Exchange, Sandhill, Newcastle-upon-Tyne.

ORIGINAL RESEARCH—ANNOUNCEMENT.

The long-sought for Governing Principles of Dr. Dalton's Doctrine of Definite, Reciprocal, and Multiple Proportions have been discovered: including a complete elucidation of the Governing Principles of the Substitution, Hydrogen-replacement, and Compound Radical Theories—Inorganic and Organic—of Modern Chemistry.

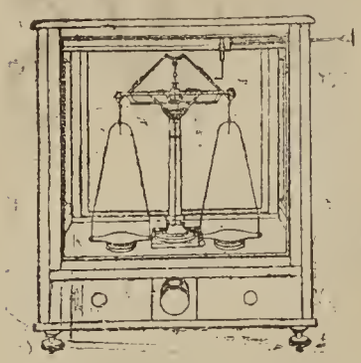
These original discoveries are of the highest possible interest from a scientific point of view, not only from the immense range of obscure phenomena explained, but also in pointing to new paths of enquiry and research.

A knowledge of these principles will enable the chemist to unite theory with practice: for they elucidate the most profound mysteries of his science, and explain in a lucid, clear, and intelligible manner (permitting of immediate practical verification) the fundamental principles that govern the formation of all chemical compounds, from the simplest combinations to the most complex. Due notice of publication will be advertised.—"ERBERTMA."

NOTICE TO THE TRADE.

To prevent delay and to suit the convenience of the Wholesale Newsagents the CHEMICAL NEWS *will in future be printed on Thursday night, and delivered to the trade at 9 o'clock on Friday morning.*

Boy Court, Ludgate Hill,
May 1, 1878.



L. OERTLING,

TURNMILL STREET

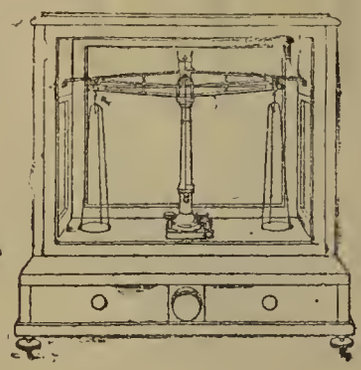
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

MILTON CHEMICAL WORKS, STOKE-ON-TRENT, STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

---

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS

LIQUOR AMMONIA, &c.

F. Chemiker, Techniker, Fabrik., Ingenieure, Apotheker, Aerzte, Landwirthe. Chemisches Central-Annoncenblatt. Erscheint wöchentl. Durch j. Postanst. u. Buchhdl. zu beziehen. Preis viertelj. 2,50 M., durch Streifb. 3 M., nach dem Auslande 4,00 M. ANZEIGEN: 30 Pf. p. Zeile. Probenummern kostenfrei!

THOMAS ADKINS & CO.,

SMETHWICK,

NEAR BIRMINGHAM.

MANUFACTURERS OF SPECIALLY PREPARED RED LEAD FOR FLINT-GLASS MAKING.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

A. BOAKE & CO.,

STRATFORD, LONDON, E.,

MAKERS OF

THE SULPHITES AND BISULPHITES

OF

SODA AND LIME.

ENLARGEMENT OF "NATURE."

NATURE:

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE.

From May 2, the commencement of a new volume, NATURE was enlarged and the price raised to 6d.

This step has been necessitated by the success which has been achieved during the period, upwards of eight years, which has elapsed since the journal was first started, a success due to the generous response which has been made to the endeavours to obtain the earliest information on all affairs touching scientific progress from all parts of the world.

The quantity of important matter now received during each week from both hemispheres so largely exceeds the space at present at the Editor's disposal, that as an inevitable result the publication of valuable new results and interesting information is often delayed for a considerable time.

This large increase is mainly due to the formation of new scientific societies and associations both in our own and other countries, and to the valuable aid afforded us by our subscribers and readers, some of them in the more remote and least known spots on the earth's surface.

The following list of places from which we occasionally receive correspondence will give an idea of the manner in which NATURE now circulates in regions far outside the range of the ordinary newspapers:—Itajahy (South Brazil), Samoa, Borneo, Graaf Reinet (South Africa), New Guinea, Johore, Champion Bay (Gulf of Siam), Nukus (Amu Delta), Dehra Doon (North-West Provinces), Philippine Islands, Willunga (South Australia), Puerto Plata (Sto. Domingo), Saigon (Cochin China), Hailer Grace (Newfoundland), Manado (Celebes), Pietermaritzburg (Natal), Kaffraria, Ohinitahi (New Zealand), Jask (Persian Gulf.) We might have largely increased this list had we given the names of the many other places in India where we have either regular or occasional correspondents, besides places in China, Japan, remote parts of America, Australia, and New Zealand.

Nor must we omit to state that from the United States in which NATURE circulates more widely than any other English journal, we receive early proofs of many of the valuable contributions to scientific theory, exploration, and practice, the rapidly increasing number of which is one of the most remarkable indications of scientific progress to be noted in our time.

We have, it need scarcely be said, regular Correspondents in all the principal countries of Europe, and as our pages testify, our reviewers and other contributors are not confined to English men of science. We are gratified to state that we are able, when we deem it advisable, to be the medium of communication of the opinions of the most eminent men of science in Europe and America on any important subject attracting general attention. Any one looking over the seventeen volumes of NATURE will find there as contributors, at one time or other, the most prominent names of our time.

That NATURE has thus been able to attract to her pages as contributors or correspondents, not only the leading scientific men of all countries, but many others who quietly cultivate science in their leisure hours in the most remote parts of the world, and that a love for science is spreading more and more appear to the proprietors to indicate that in its new form NATURE will prove more attractive and useful, because fuller and more varied, than ever.

PUBLISHED EVERY THURSDAY AFTERNOON, PRICE SIXPENCE.

Subscriptions:—Yearly, 28s.; Half-Year, 14s. 6d.; Three Months, 7s. 6d.

OFFICE: 29, BEDFORD STREET, STRAND.

Chemical Apparatus & Scientific Instruments,

PORCELAIN, GLASS, STONE, WOOD, AND METAL APPARATUS

FOR

CHEMICAL AND PHILOSOPHICAL PURPOSES AND LECTURES.

ELECTRICAL, MEDICAL, AND EXPERIMENTAL COILS AND APPARATUS.

BUNSEN'S MODIFIED FILTER PUMPS, from 10s. 8d. to 67s.

ELECTRICAL BATTERIES AND ELEMENTS.

Sets of Apparatus according to Professor Valentin's "Book of Chemistry," and Professor Attfield's "Manual of Chemistry."

Also Sets of Apparatus as required by the Government Schools always ready and kept in stock.

Catalogues and Illustrations will be sent Gratuitously. A Liberal Discount allowed to Wholesale Buyers.

WHOLESALE IMPORTERS AND MANUFACTURERS:

AUG. BEL & CO.,

34, Maiden Lane, Strand, London, W.C.

SOLE AGENTS FOR GRENET'S BATTERIES AND NODOT'S MICROSCOPES.

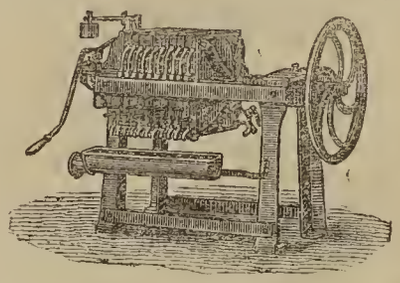
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

THE speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing are Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for udents, Schools, Colleges, &c.
NEW PATTERNS OF GEOLOGICAL HAMMERS.
EW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
8, CHARLOTTE STREET, FITZROY SQUARE

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester

SPECIALITIES.

MANGANESE	Lump, Crystallised, Ground, and Prepa ed Large stock of every description. *** *Suitable for all Trades.*
ARSENIC	Refined powdered, Lump, Grey, and Ruby.
FLUOR-SPAR	Finest produced. Medium and Common for al purposes.
BARYTES	Carbonate and Sulphate. All qualities of Lump and Ground.
BAUXITE	Of high percentage of Alumina and low in Iron.

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,
MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove and the cleanliness of application makes this one of the marvels o household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal P lytechnic Institution.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

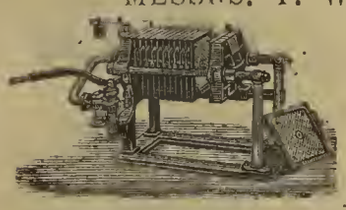
POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

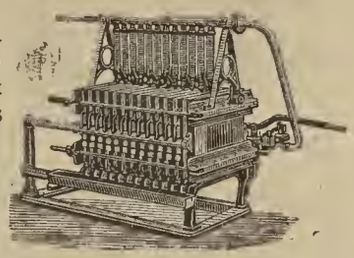
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Coal-Tar, Pitch, Creosote, Grease, Sulphate of Ammonia, Pyroligneous Acid, Acetate of Lime, Wood Naphtha, Charcoal, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

J. I. HEADLY, ENGINEER, Cambridge

Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Sole Agents or Prof. Wanklyn's Test Solutions or Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post free including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series of insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

TAR DISTILLERS
DRYSALTERS
BOUCK & Co LIMITED
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia, PITCH & CREOSOTE, SULPHATE OF COPPER, VITRIOL, Nitrate Lead, Sulp Zinc, Nitric Acids &c &c.
BRIMSTONE REFINERS
Samples & prices on application.
J. I. VAUGHAN Secretary
AGENTS FOR Best Scotch & English, RED & YELLOW PRUSSIATE, OXALIC ACID, PICRIC ACID, Sal-Acetosella, BICHROME, CHLORATE OF POTASH, &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

DOULTON & WATTS

HIGH STREET, LAMBETH, LONDON, S.E.

DEPOTS:—GRANVILLE WHARF, WOOD STREET, BIRMINGHAM; 100, SOHO STREET LIVERPOOL; AND 18, RUE MARTEL, PARIS.

MANUFACTURERS OF

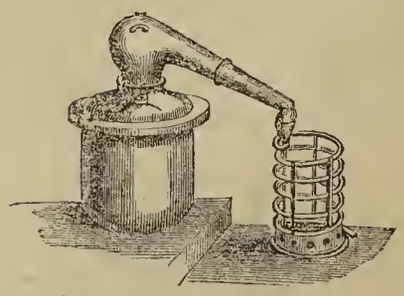
STILLS, RETORTS, CONDENSING WORMS, WOLLF'S BOTTLES

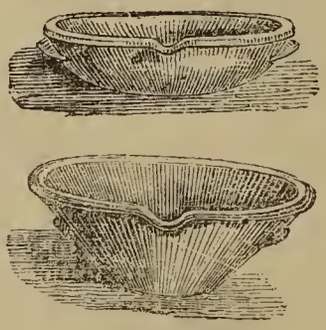
ACID PUMPS, COCKS, PERCOLATORS, AIR-TIGHT JARS,

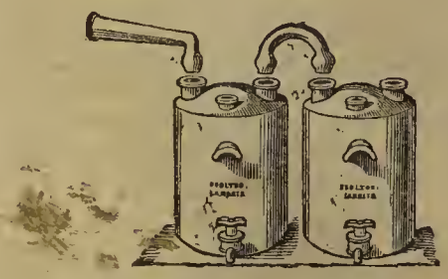
AND EVERY DESCRIPTION OF

STONEWARE FOR CHEMICAL PURPOSES,

Warranted to Resist the Strongest Acids.







PLUMBAGO CRUCIBLES, AND OTHER FIRE-STANDING GOODS.

CHEMISTS' AND DRUGGISTS' GLASS. PORCELAIN TAPS.

PRICE LISTS of any of the above, and of Every Description of Stoneware, may be had on application, and Samples seen at

Messrs. D. and W.'s SHOW ROOMS, HIGH STREET, LAMBETH.

KRYOLITH

FROM GREENLAND.

MAYER & HENCKEL,

COPENHAGEN.

FACTORIES:
Reddish and Bradford,
MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

TOWN OFFICES:
61, Piccadilly,
MANCHESTER.

MANUFACTURERS OF

PURE CARBOLIC ACID,	Cryst. at	42°·2	C.	} Discovered by C. Lowe.	
,, ,,	do. Hydrate of				
MEDICINAL	do. Cryst. at	35°	C.		
COMMERCIAL	do. No. 1 ,,	35°	C.		
,,	do. 2 ,,	29°	C.		
,,	do. 3 ,,	12°	C.		
,,	do. 4 liquid at	0°	C.		
CARBOLIC ACID DISINFECTING POWDER.					

CARBOLIC ACID GLYCERINE SOLUTIONS.
CRESYLIC ACID.
SULPHO-PHENIC ACID (CRYST.
SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.

BENZOL (Cryst.).
ANTHRACENE.
NAPHTHALINE.
PICRIC ACID (Crystal and Paste).
AURINE (Rosolic Acid) Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

JOHN CLIFF,

STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
& CO IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY
RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court Ludgate Hill, E C
May 3, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [*Established Twenty-six Years.*

Vol. 37.—No. 963.] *Copyright reserved.* Friday, May 10, 1878. *Registered as a Newspaper.* [PRICE, 4*d*. POST FREE, 4½*d*.

CONTENTS.

ARTICLES:— PAGE
Paraffins in Commercial "Water-gas," by Henry Morton, Ph.D., and Wm. E. Geyer, B.S. 187
On Dyer's Chemicals, by J. Marzell 188
PROCEEDINGS OF SOCIETIES:—
CHEMICAL SOCIETY.—On the Chemical Aspects of Vegetable Physiology 190
TYNE CHEMICAL SOCIETY.—President's Address 192
CORRESPONDENCE.—Relation between Gaseous Volume and Valency—Nitric Acid in the Vitriol Manufacture—Nitre Loses in the Vitriol Manufacture 194
CHEMICAL NOTICES FROM FOREIGN SOURCES 195

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

IRON AND STEEL WORKS.

A Gentleman (23), with thorough scientific education, for some time chemist of iron works in the North of England, also of experience in steel works, desires Situation as Chemist or Assistant. Best testimonials.—Address, Ferro, CHEMICAL NEWS Office, Boy Court, Ludgate Hill London, E.C.

CERESIN (MINERAL-WAX, REFINED OZOKERIT).

Advertiser, who is thoroughly acquainted with the manufacturing of above-named article, is prepared to undertake the establishment of a manufactory of same. He also is in a position to prove that he can obtain a most beautiful product at extremely reduced cost.—Bona fide applications please direct by letter to S. 1687, at Rudolf Mosse's Foreign Advertising Agency, 1, Old Change, Cheapside, London, E.C.

Wanted, to Purchase, a Small Analytical Practice. Principals only dealt with.—Address, N. R. E., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

GRIFFIN'S
CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

Just published, price 2s. 6d.

THE LONDON WATER SUPPLY. By CHARLES MEYMOTT TIDY, M.B., Professor of Chemistry at the London Hospital.
London: J. and A. CHURCHILL.

MACTEAR'S PATENT CARBONATING FURNACE,
AND
JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,
MANUFACTURED BY
R. DAGLISH & CO.,
ST. HELEN'S ENGINE AND BOILER WORKS,
LANCASHIRE.

Prices and other particulars on application.

An Active and Energetic Agent in Hamburg, with good connections, wishes to represent some First Class Chemical Works. Undeniable references.—Address, H.H., 4, Falcon Street, Aldersgate Street, London.

ORIGINAL RESEARCH—ANNOUNCEMENT

The long-sought for Governing Principles of Dr. Dalton's Doctrine of Definite, Reciprocal, and Multiple Proportions have been discovered: including a complete elucidation of the Governing Principles of the Substitution, Hydrogen-replacement, and Compound Radical Theories—Inorganic and Organic—of Modern Chemistry.

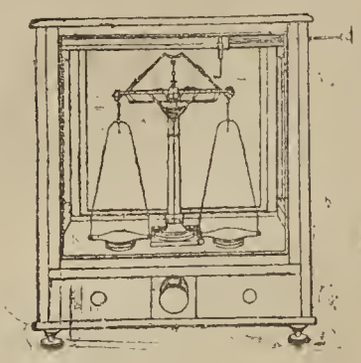
These original discoveries are of the highest possible interest from a scientific point of view, not only from the immense range of obscure phenomena explained, but also in pointing to new paths of enquiry and research.

A knowledge of these principles will enable the chemist to unite theory with practice: for they elucidate the most profound mysteries of his science, and explain in a lucid, clear, and intelligible manner (permitting of immediate practical verification) the fundamental principles that govern the formation of all chemical compounds, from the simplest combinations to the most complex. Due notice of publication will be advertised.—"ERBERTMA."

NOTICE TO THE TRADE.

To prevent delay and to suit the convenience of the Wholesale Newsagents the CHEMICAL NEWS *will in future be printed on Thursday night, and delivered to the trade at 9 o'clock on Friday morning.*

Boy Court, Ludgate Hill,
May 1, 1878.



L. OERTLING,

TURNMILL STREET

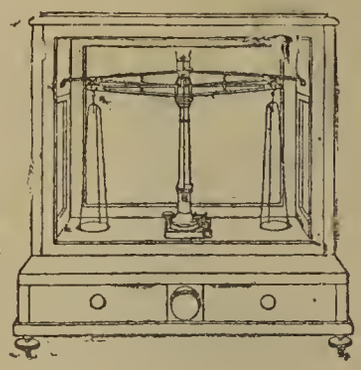
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

MILTON CHEMICAL WORKS, STOKE-ON-TRENT, STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C; who hold stock ready for delivery.

THE ELECTRICIAN.

The FIRST NUMBER of a WEEKLY PAPER under the above title will be published EARLY THIS MONTH.

Price 4d.

Office: 396, STRAND.

MR. COX, VALUER OF CHEMICAL PLANT, offers his services on the usual terms. Twenty years' experience. Estimates for all description of plant, plans, &c.—Glenmohr House, New Charlton, London, S.

ASH-MILL, complete, with revolving dish, edge rollers, perforated grids, crusher, elevator, patent packing machine with revolving table, &c. Also 14-horse power horizontal engine for driving same; all nearly new; for sale very cheap, owing to want of room.—Apply to W. Pilkington and Son, Widnes, Lancashire

In einer grossen Sodafabrik des Continents wird ein junger Mann gesucht, der in der Fabrikation von Schwefelsaeure, Soda, und Detznatron in englischen Fabriken Erfahrungen hat und im Stande ist, deren Fabrikation zu leiten.—Gefaellige, Offerten sub F. 62026, an Haasenstein and Vogler, Frankfurt a-M.

Wanted, for the Laboratory of a Chemical works, a Chemist with experience in the Aniline Dyes. Outside work might be accepted.—W. L., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Wanted, in July, by a Student of the Royal College of Chemistry, an Engagement as Chemist or Assistant in a Works.—Address, K. L., care of E. Henley, 6, Willow Terrace, Canonbury, London, N.

Wanted, an Assayer: one that has made zinc products a speciality.—Address, with references and stating remuneration, Zn, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

THE TELEPHONE.

Arrangements for Exhibiting or Fixing on application to EDWARD PATERSON, Telegraph Engineer, 3, Bedford Court, Covent Garden, W.C. Insulated Wires, Call-Bells, Insulators, and Galvanised Wire for Overhead Lines. Electric House-Bells, and all descriptions of Electrical Apparatus for experimental and other purposes. Price list post free 2 stamps.

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy. "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

To be Sold, by Private Contract, an excellent and old-established Chemical Manufacturing and Drysalting Business, together with extensive works at Manchester, Glasgow, and Ayr. The business is a very lucrative one, and is in full working order. The sole reason for selling is the death of the last surviving partner. Only principals or their solicitors will be treated with.—Apply to Slater, Heelis, and Co., Solicitors, 75, Princes Street, Manchester.

THOMAS ADKINS & CO.,

SMETHWICK,

NEAR BIRMINGHAM

MANUFACTURERS OF SPECIALLY PREPARED RED LEAD FOR FLINT-GLASS MAKING.

ENLARGEMENT OF "NATURE."

NATURE:

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE.

FROM May 2, the commencement of a new volume, NATURE was enlarged and the price raised to 6d.

This step has been necessitated by the success which has been achieved during the period, upwards of eight years, which has elapsed since the journal was first started, a success due to the generous response which has been made to the endeavours to obtain the earliest information on all affairs touching scientific progress from all parts of the world.

The quantity of important matter now received during each week from both hemispheres so largely exceeds the space at present at the Editor's disposal, that as an inevitable result the publication of valuable new results and interesting information is often delayed for a considerable time.

This large increase is mainly due to the formation of new scientific societies and associations both in our own and other countries, and to the valuable aid afforded us by our subscribers and readers, some of them in the more remote and least known spots on the earth's surface.

The following list of places from which we occasionally receive correspondence will give an idea of the manner in which NATURE now circulates in regions far outside the range of the ordinary newspapers:—Itajahy (South Brazil), Samoa, Borneo, Graaf Reinet (South Africa), New Guinea, Johore, Champion Bay (Gulf of Siam), Nukus (Amu Delta), Dehra Doon (North-West Provinces), Philippine Islands, Willunga (South Australia), Puerto Plata (Sto. Domingo), Saigon (Cochin China), Hailer Grace (Newfoundland), Manado (Celebes), Pietermaritzburg (Natal), Kaffraria, Ohinitahi (New Zealand), Jask (Persian Gulf.) We might have largely increased this list had we given the names of the many other places in India where we have either regular or occasional correspondents, besides places in China, Japan, remote parts of America, Australia, and New Zealand.

Nor must we omit to state that from the United States in which NATURE circulates more widely than any other English journal, we receive early proofs of many of the valuable contributions to scientific theory, exploration, and practice, the rapidly increasing number of which is one of the most remarkable indications of scientific progress to be noted in our time.

We have, it need scarcely be said, regular Correspondents in all the principal countries of Europe, and as our pages testify, our reviewers and other contributors are not confined to English men of science. We are gratified to state that we are able, when we deem it advisable, to be the medium of communication of the opinions of the most eminent men of science in Europe and America on any important subject attracting general attention. Any one looking over the seventeen volumes of NATURE will find there as contributors, at one time or other, the most prominent names of our time.

That NATURE has thus been able to attract to her pages as contributors or correspondents, not only the leading scientific men of all countries, but many others who quietly cultivate science in their leisure hours in the most remote parts of the world, and that a love for science is spreading more and more appear to the proprietors to indicate that in its new form NATURE will prove more attractive and useful, because fuller and more varied, than ever.

PUBLISHED EVERY THURSDAY AFTERNOON, PRICE SIXPENCE.

Subscriptions:—Yearly, 28s.; Half-Year, 14s. 6d.; Three Months, 7s. 6d.

OFFICE; 29, BEDFORD STREET, STRAND.

CALVERT'S CARBOLIC ACID.

HIGHEST PRIZE MEDAL AT PARIS EXHIBITION, 1867.

GOLD AND SILVER MEDALS, HAVRE, 1868. DIPLOME D'EXCELLENCE, AMSTERDAM

SILVER MEDAL, FIRST CLASS, NAPLES, 1871. GOLD MEDAL, MOSCOW, 1872.

F. C. CALVERT & CO., of Bradford, Manchester (original and only Manufacturers of pure Medical Carbolic Acid), beg to inform the Trade and large Consumers that their pure Medical Carbolic as well as cheaper qualities for Commercial, Veterinary, and Disinfecting Purposes, also Carbolic Acid Soaps for Medical, Toilet, and General Use, Soft Soap fo Dogs, and Carbolic Acid Disinfecting Powder, may be had from any of the below-named Wholesale Agents—

Apothecaries' Soc., Lond'n	Clarke, Bleasdale, & Co.	Hodgkinsons, Preston, & King	W. Mather	James Sim & Co,
Apothecaries' Co., Glasg'w	Clay, Dod, & Case	Hearon, Squire, & Francis	McMaster, Hodgson, & Co.	Sang & Barker
Apothecaries' Hall, Dublin	Dakin Brothers	Hopkin & Williams	J. F. Macfarlan & Co.	Southall, Bros., & Co.
Allen & Hanburys	Davy, Yates, & Co.	Howards & Sons	J. Mackay	W. Smeeton
J. Bell & Co.	Duncan, Flockhart, & Co.	Hirst, Brooke, & Co.	R. H. Millard & Son	Slinger & Barnett
Barron, Harveys, & Co.	W. Edwards & Son	W. R. Hatrick & Co.	Mackey, Sellers, & Co.	P. Sandeman & Co.
Barclay & Sons.	Evans, Lescher, & Evans	P. Harris & Co.	Mottershead & Co.	Tidman & Son
Burgoyne & Co.	Evans, Sons, & Co.	Hunt & Co.	Newbery & Sons	Taylor, Gibson, & Co.
Baiss Brothers & Co.	Evans, Gadd, & Co.	J. Ismay	Paterson & Son	Thacker & Hoffe
Barron, Squire, & Co.	Ferris & Co.	Johnson & Sons	Raimes & Co.	Jas. Taylor
Battley & Watts	Glasgow New Apoth. Co.	Langtons, Edden, & Hicks	J. Richardson & Co.	J. Woolley, Sons, & Co
Bewley & Draper	General Apothecaries' Co.	Lynch & Co.	Raimes, Blanshards, & Co.	Wyleys & Co.
H. B. Brady	W. & H. M. Goulding	Lofthouse & Saltmer	J Reddish & Co.	Wilson & Kitchen
Bainbridge & Pound	Goodall, Backhouse, & Co.	Chas. Leslie	Sanger & Sons	C. H. Warner & Co.
Boileau & Boyd	Grimwade, Ridley, & Co.	Maw, Son, & Thompson	Savory & Moore.	A. & J. Warren
Curling & Co.	Hodgkinsons, Stead, & Co.	H. C. Mason	W. Sutton & Co.	Walkington & Son
Corbyn & Co.	Herrings & Co.		R. Sumner & Co.	Wright, Layman, & Umney

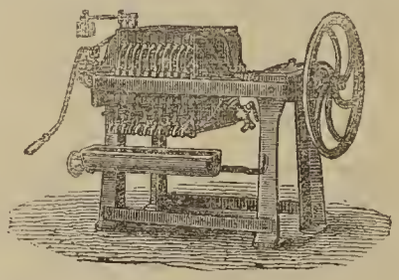
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

The speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction to Suit Special Requirements.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40*s.* and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing rare Elements, &c., for Chemical Purposes, Experiment, and Research.
Also, Elementary Collections of Minerals, Fossils, and Rocks, for Students, Schools, Colleges, &c.
NEW PATTERNS OF GEOLOGICAL HAMMERS.
NEW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
8, CHARLOTTE STREET, FITZROY SQUARE

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester

SPECIALITIES.

MANGANESE	Lump, Crystallised, Ground, and Prepa ed Large stock of every description. *** *Suitable for all Trades.*
ARSENIC	Refined powdered, Lump, Grey, and Ruby.
FLUOR-SPAR	Finest produced. Medium and Common for al purposes.
BARYTES	Carbonate and Sulphate. All qualities of Lump and Ground.
BAUXITE	Of high percentage of Alumina and low in Iron:

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—Special attention is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA

Ryall's Chemical Black Lead (Registered) creates no waste or dust hy its magnetic adherence to the stove and the cleanliness of application makes this one of the marvels o household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal P lytechnic Institution.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.

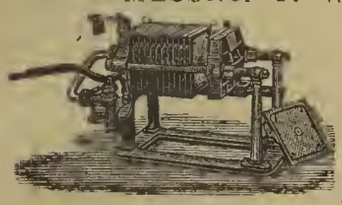
SULPHATE OF AMMONIA, ANTHRACENE
BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

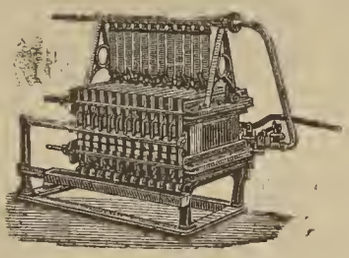
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also prote ct purchasers against any alleged infringements of paten ts held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Coal-Tar, Pitch, Creosote, Grease, Sulphate of Ammonia, Pyroligneous Acid, Acetate of Lime, Wood Naphtha, Charcoal, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

J. I. HEADLY, ENGINEER, Cambridge
Maker of Steam Engines, Bone Mills, and other Machinery r Chemical Works; also Whole and Ground Coprolite.

TOWNSON & MERCER
(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Sole Agents or Prof. Wanklyn's Test Solutions or Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post free including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series of insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

PATENTS. PATENTS.

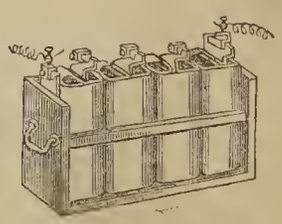
ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street, London.

TAR DISTILLERS
DRYSALTERS
BOUCK & Co LIMITED
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp Zinc. Nitric Acids &c &c
BRIMSTONE REFINERS
Samples & prices on application.
J. I. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE Oxalic Acid. PICRIC ACID, Sal-Aceto CHLORATE OF POTASH, &c. &c. BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

CHEMICAL & SCIENTIFIC APPARATUS,

WHOLESALE AND RETAIL.

EVERY DESCRIPTION OF APPARATUS FOR STUDY, LECTURES, OR RESEARCH.



Country Orders, accompanied by a remittance, executed same day as received; and carriage paid in England and Wales if over £2 in value.

PRICE LISTS POST FREE ON APPLICATION.

M. JACKSON AND CO.,

65, BARBICAN, LONDON.

EARP & CHASTER,
RUNCORN,
MAKERS OF
CHEMICALLY PURE MINERAL ACIDS
LIQUOR AMMONIA, &c.

BISULPHIDE OF CARBON,
CHLORIDE OF SULPHUR.

GAS PURIFICATION & CHEMICAL CO., LIMITED,
161, 162, 163, Palmerston Buildings, London, E.C

FACTORIES:
Reddish and Bradford,
MANCHESTER.

CHARLES LOWE & CO.,

(Established 1860.)

TOWN OFFICES:
61, Piccadilly,
MANCHESTER.

MANUFACTURERS OF

Pure Carbolic Acid, Cryst. at 42°·2 C. } Discovered by C. Lowe.
,, ,, do. Hydrate of
Medicinal do. Cryst. at 35° C.
Commercial do. No. 1 ,, 35° C.
,, do. 2 ,, 29° C.
,, do. 3 ,, 12° C.
,, do. 4 liquid at 0° C.
Carbolic Acid Disinfecting Powder.

Carbolic Acid Glycerine Solutions.
Cresylic Acid.
Sulpho-Phenic Acid (Cryst.
Sulpho-Phenates & Sulpho-Cresylates of Soda, Potash, Zinc, Iron, and Alumina.

Benzol (Cryst.).
Anthracene.
Naphthaline.
Picric Acid (Crystal and Paste).
Aurine (Rosolic Acid) Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesa and Export Houses.

JOHN CLIFF,
STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
& IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY
RUNCORN.

London: Printed and Published for the Proprietor by Edwin John Davey, at the Office, Boy Court, Ludgate Hill, E C
May 10, 1878.

OF GREAT BRITAIN

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [Established Twenty-six Years.

Vol. 37.—No. 964.] Copyright reserved. Friday, May 17, 1878. Registered as a Newspaper. [PRICE, 4d. POST FREE, 4½d.

CONTENTS.

ARTICLES:— PAGE
On the Action of Sonorous Vibrations in Varying the Force of an Electric Current, by Prof. Hughes 197
Notes of Work done in Messrs. Pokorny, Fielder, and Co.'s Laboratory, by E. Sonstadt, F.I.C., F.C.S. 199
On the Specific Gravity of Some Specimens of Bessemer Steel, by Sergius Kern, M.E. 199
On the Chemical and Mechanical Analyses of Cast-Steels, by Sergius Kern, M.E. 200
Contributions to Blowpipe Chemistry, by P. Casamajor 200
Composition and Quality of the Metropolitan Water 202
CORRESPONDENCE.—Burnard's Patent for Supplying Sulphuric Acid Chambers with Nitre 203
CHEMICAL NOTICES FROM FOREIGN SOURCES 203

SULPHATE OF LEAD,

LEAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

IRON AND STEEL WORKS.

A Gentleman (23), with thorough scientific education, for some time chemist of iron works in the North of England, also of experience in steel works, desires Situation as Chemist or Assistant. Best testimonials.—Address, Ferro, CHEMICAL NEWS Office, Boy Court, Ludgate Hill London, E.C.

CERESIN (MINERAL-WAX, REFINED OZOKERIT).

Advertiser, who is thoroughly acquainted with the manufacturing of above-named article, is prepared to undertake the establishment of a manufactory of same. He also is in a position to prove that he can obtain a most beautiful product at extremely reduced cost.—Bona fide applications please direct by letter to S. 1687, at Rudolf Mosse's Foreign Advertising Agency, 1, Old Change, Cheapside, London, E.C.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

GRIFFIN'S
CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS;
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

MACTEAR'S PATENT CARBONATING FURNACE,
AND
JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,
MANUFACTURED BY
R. DAGLISH & CO.,
ST. HELEN'S ENGINE AND BOILER WORKS,
LANCASHIRE.
Prices and other particulars on application.

A Young Gentleman, who is about completing his three years' study in the Owens College Chemical Laboratories, desires a Situation as Chemist in a Chemical, Calico-Printing, or other works.—Address, E. A. B., 13, Withington Road, Brook's Bar, Manchester.

ORIGINAL RESEARCH—ANNOUNCEMENT.

The long-sought for Governing Principles of Dr. Dalton's Doctrine of Definite, Reciprocal, and Multiple Proportions have been discovered: including a complete elucidation of the Governing Principles of the Substitution, Hydrogen-replacement, and Compound Radical Theories—Inorganic and Organic—of Modern Chemistry.

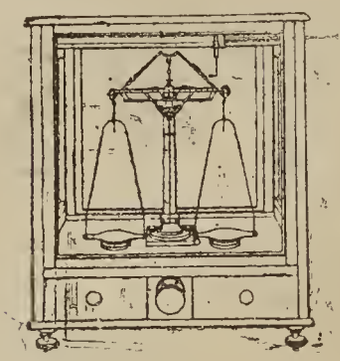
These original discoveries are of the highest possible interest from a scientific point of view, not only from the immense range of obscure phenomena explained, but also in pointing to new paths of enquiry and research.

A knowledge of these principles will enable the chemist to unite theory with practice: for they elucidate the most profound mysteries of his science, and explain in a lucid, clear, and intelligible manner (permitting of immediate practical verification) the fundamental principles that govern the formation of all chemical compounds, from the simplest combinations to the most complex. Due notice of publication will be advertised.—"ERBERTMA."

NOTICE TO THE TRADE.

To prevent delay and to suit the convenience of the Wholesale Newsagents the CHEMICAL NEWS *will in future be printed on Thursday night, and delivered to the trade at 9 o'clock on Friday morning.*

Boy Court, Ludgate Hill,
May 1, 1878.



L. OERTLING,

TURNMILL STREET

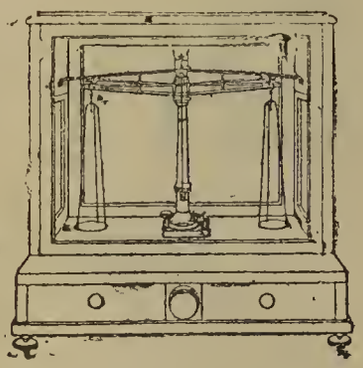
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glyccrine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

MILTON CHEMICAL WORKS, STOKE-ON-TRENT, STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

CIVIL SERVICE COMMISSION.

Open Competition for Six Indexing and Abridging Clerkships in the Patent Office in London, June 18; preliminary examination in London, Edinburgh, and Dublin, June 4. Age 21 to 25.—Forms of application may be obtained at once from the Secretary.

A Vacancy offers for a Young Man capable of making manure analyses, who writes well; salary begins at 20s. per week, with annual increase and fair prospects.—Address, Beta, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Wanted, by a Third Years' Chemical Student (Owens College, Manchester), a Situation as Chemist or Under-Manager in a Chemical Works; Tar Distillery preferred. Highest references given.—Address B., 20 and 22, Market Street, Hyde, Cheshire.

Wanted, an Assayer: one that has made zinc products a speciality.—Address, with references and stating remuneration, Zn, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

GUANO AND CHEMICAL MANURES.

Salesman wanted by a first class house to sell to wholesale buyers and to superintend and appoint agents.—Address, stating experience, &c., M. N., Nissen and Arnold, 43, Mark Lane, E C.

MR. COX, VALUER OF CHEMICAL PLANT, offers his services on the usual terms. Twenty years' experience. Estimates for all description of plant, plans, &c.—Glenmohr House, New Charlton, London, S.

In einer grossen Sodafabrik des Continents wird ein junger Mann gesucht, der in der Fabrikation von Schwefelsaeure, Soda, und Detznatron in englischen Fabriken Erfahrungen hat und im Stande ist, deren Fabrikation zu leiten.—Gefaellige, Offerten sub F. 62026, an Haasenstein and Vogler, Frankfurt a-M.

ASH-MILL, complete, with revolving dish, edge rollers, perforated grids, crusher, elevator, patent packing machine with revolving table, &c. Also 14-horse power horizontal engine for driving same; all nearly new; for sale very cheap, owing to want of room.—Apply to W. Pilkington and Son, Widnes, Lancashire

THOMAS ADKINS & CO.,

SMETHWICK,

NEAR BIRMINGHAM

MANUFACTURERS OF SPECIALLY PREPARED RED LEAD FOR FLINT-GLASS MAKING.

A. BOAKE & CO.,

STRATFORD, LONDON, E.,

MAKERS OF

THE SULPHITES AND BISULPHITES

OF

SODA AND LIME.

CHEMISTS AND MANUFACTURERS

Are solicited, before purchasing FILTER-PRESSES, to examine the merits of

JOHNSON'S PATENT HYDRAULIC FILTER,

And see whether, for—

CORRECTNESS OF PRINCIPLE,
DESIGN,
CONVENIENCE AND ECONOMY IN WORKING,
SOLIDITY AND EXCELLENCE OF WORKMANSHIP,
AND LOWNESS OF PRICE,

is not by far the BEST, CHEAPEST, and MOST RAPID MEANS OF FILTRATION IN THE MARKET, for—

SEPARATING SOLIDS FROM SEMI-FLUIDS,
FILTERING LIQUIDS BRIGHT,
WASHING PRECIPITATES,
DRYING PRECIPITATES, SLURRY OR SLUDGE.

in any quantities, large or small, with great economy in cloths, which never burst and are easily removed for cleaning when required. These are advantages which command its adoption over every other form of Filter.

Trials at the Works made Gratis in presence of Intending Purchasers.

Small Filter-Press for Laboratory Use, with Pump complete ... ... from £7.

JOHNSON'S ENGINEERING WORKS,
CARPENTER'S ROAD, STRATFORD.
LONDON OFFICES - - - - - - - N. NUTTER, 71, CORNHILL, E.C.

BISULPHIDE OF CARBON,
PROTOSULPHATE,
RED OXIDE
OXYCHLORIDE

Sulphocyanide,
And every other Mercurial Preparation.

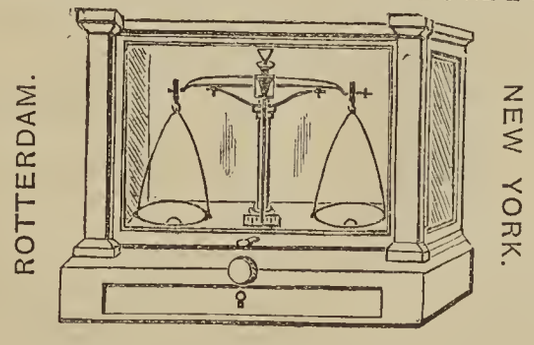
BISULPHITE OF LIME, TETRACHLORIDE OF CA
Oxysulphuret of Antimony, Glacial Acetic Acid,

LIQUOR AMMONIÆ,
SULPHIDE OF IRON,
PURE ACIDS,
CHLORIDE OF SULPHUR,
ACETONE,
CHLOROFORM,
ALDEHYDE,
CHLORATE BARYTA,
ARSENIC ACIDS,
FRUIT ESSENCES FOR CONFECTIONERY & LIQUEURS,
PERCHLORIDE OF IRON,
SULPHITE AND HYPOSULPHITE OF SODA,
PHOSPHATES OF SODA AND AMMONIA,
ETHERS,
BROMIDES,
IODIDES,
SCALE AND GRANULAR PREPARATIONS.

ALSO,
Pure Photographic Chemicals of every kind.
MANUFACTURED BY
WILLIAM BAILEY & SON,
HORSELEY FIELDS CHEMICAL WORKS,
WOLVERHAMPTON

EARP & CHASTER,
RUNCORN,
MAKERS OF
CHEMICALLY PURE MINERAL ACIDS
LIQUOR AMMONIA, &c.

BECKER & SONS,
MANUFACTURERS OF
CHEMICAL AND GOLD ASSAY BALANCES
AND OTHER
SCALES AND WEIGHTS.



BECKER'S STUDENT'S BALANCE, in polished mahogany glass case, sliding front, counterpoised, to carry 30 grammes in each pan and turn to ½ milligramme, nickel plated pans.. £2 10
Ditto, ditto, in mahogany glass case, polished black £2 13

Sole Agents for England, Ireland, and Wales:—
TOWNSON & MERCER,

Becker's Complete Lists forwarded by post on receipt of 1*d.* stamp, or free on application.

ERECTION OF PLANT.

TO SULPHATE OF AMMONIA MANUFACTURERS AND OTHERS.

STILLS, SATURATORS, and all APPARATUS in connection with the above Erected upon the Most Approved Plan—result of 15 years practical experience.—Address, G. Tunbridge, Man. Chem. Dept., Gas Works, Leicester, or J. Barnes, Plumber, &c., Barking, Essex.

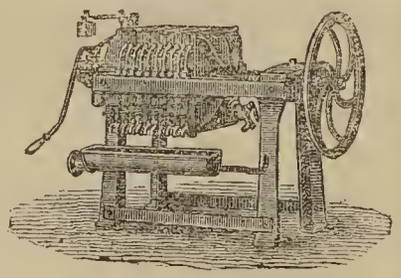
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

The speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction to Suit Special Requirements.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40*s.* and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing rare Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for Students, Schools, Colleges, &c.

NEW PATTERNS OF GEOLOGICAL HAMMERS.
NEW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
88, CHARLOTTE STREET, FITZROY SQUARE

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester

SPECIALITIES.

MANGANESE	Lump, Crystallised, Ground, and Prepa ed Large stock of every description. *** *Suitable for all Trades.*
ARSENIC	Refined powdered, Lump, Grey, and Ruby.
FLUOR-SPAR	Finest produced. Medium and Common for al purposes.
BARYTES	Carbonate and Sulphate. All qualities of Lump and Ground.
BAUXITE	Of high percentage of Alumina and low in Iron.

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—Special attention is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove and the cleanliness of application makes this one of the marvels o household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal P lytechnic Institution.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

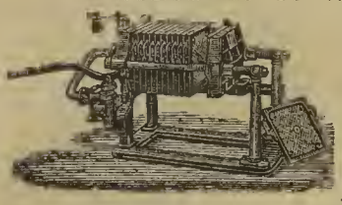
POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

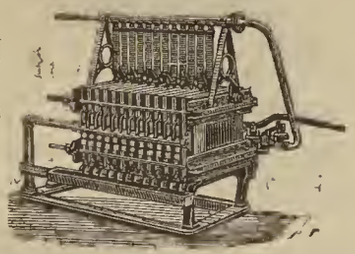
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.
And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Coal-Tar, Pitch, Creosote, Grease, Sulphate of Ammonia, Pyroligneous Acid, Acetate of Lime, Wood Naphtha, Charcoal, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

J. I. HEADLY, ENGINEER, Cambridge

Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.

Sole Agents or Prof. Wanklyn's Test Solutions or Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post free including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series of insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street, London.

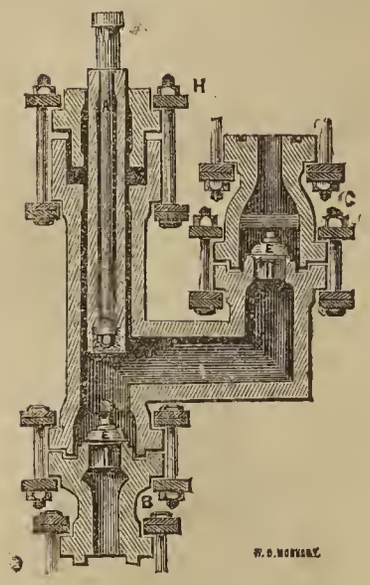
TAR DISTILLERS
DRYSALTERS
BOUCK & Co LIMITED
MILES PLATTING, MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia, PITCH & CREOSOTE, SULPHATE OF COPPER, VITRIOL, Nitrate Lead, Sulp Zinc, Nitric Acids, &c. &c.
BRIMSTONE REFINERS
Samples & prices on application.
J. I. VAUGHAN Secretary
AGENTS FOR Best Scotch & English, RED & YELLOW PRUSSIATE, OXALIC ACID, PICRIC ACID, Sal-Acetosella, BICHROME, CHLORATE OF POTASH, &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

DOULTON & WATTS

HIGH STREET, LAMBETH, LONDON, S.E.

MANUFACTURERS OF

STONEWARE ACID PUMPS AND COCKS,



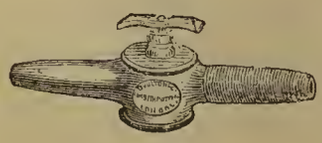
STILLS, RETORTS, CONDENSING WORMS

WOLFF'S BOTTLES

PERCOLATORS, AIR-TIGHT JARS,

And every description of Stoneware or Chemical Purposes, warranted to resist the strongest acids.

PLUMBAGO CRUCIBLES AND OTHER FIRE-STANDING GOODS.



CHEMISTS' & DRUGGISTS' GLASS. PORCELAIN TAPS

Price Lists of any of the above, and of every description of Stoneware, may be had on application.

Messrs. D. and W. were awarded a **MEDAL** for **ACID PUMPS**, and also one for **PLUMBAGO CRUCIBLES**, at the Vienna Exhibition, 1873.

Head Offices and Show Rooms, HIGH STREET, LAMBETH, S.E

Depots :—Granville Wharf, Wood Street, Birmingham; 100, Soho Street, Liverpool; Hope Street, Salford Manchester; and 6, Rue de Paradis Poissonière, Paris.

WILL BE PUBLISHED ON MAY 25.

THE ELECTRICIAN.

PRICE 4D.

A WEEKLY JOURNAL OF

THEORETICAL AND APPLIED ELECTRICITY AND CHEMICAL PHYSICS.

OFFICE: 396, STRAND, W.C.

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

MANUFACTURERS OF

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

PURE CARBOLIC ACID, Cryst. at 42°·2 C.	Discovered by C. Lowe.	CARBOLIC ACID GLYCERINE SOLUTIONS.	BENZOL (Cryst.).
,, ,, do. Hydrate of		CRESYLIC ACID.	ANTHRACENE.
MEDICINAL do. Cryst. at 35° C.		SULPHO-PHENIC ACID (CRYST.	NAPHTHALINE.
COMMERCIAL do. No. 1 ,, 35° C.		SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.	PICRIC ACID (Crystal and Paste).
,, do. 2 ,, 29° C.			AURINE (Rosolic Acid) Cake and Solution.
,, do. 3 ,, 12° C.			
,, do. 4 liquid at 0° C.			
CARBOLIC ACID DISINFECTING POWDER.			

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Who and Export Houses.

JOHN CLIFF, STONEWARE MANUFACTURER, Late JOHN CLIFF & Co. Formerly STEPHEN GREEN. & IMPERIAL POTTERIES, LAMBETH. OLD QUAY RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court, Ludgate Hill, E C May 17, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [*Established Twenty-six Years.*

Vol. 37.—No. 965.] *Copyright reserved.* Friday, May 24, 1878. *Registered as a Newspaper.* [PRICE, 4*d*. POST FREE, 4½*d*.

CONTENTS.

ARTICLES:— PAGE
Sulphate of Soda, by John Affleck, M.A., D.Sc..... 207
A Study of Plat-Ammonia Compounds, by Samuel E. Phillips .. 209
PROCEEDINGS OF SOCIETIES:—
CHEMICAL SOCIETY.—On the Detection and Estimation of Free Mineral Acids in Various Commercial Products—The Action of Hypochlorites on Urea—On the Behaviour of Metallic Solutions with Filter-paper, and on the Detection of Cadmium—On Essential Oil of Sage—On the Action of Bromine upon Sulphur—On the Determination of High Boiling-points—On High Melting-points 211
PHYSICAL SOCIETY.—Influence of Stress on Magnetisation..... 212
MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.—On the Decomposition of Ultramarine by Carbonic Acid—On Aurin—The Origin of Some Ores of Copper. 213
EDINBURGH UNIVERSITY CHEMICAL SOCIETY.—On the Gallate and Tannate of Iron..... 216
DUBLIN UNIVERSITY EXPERIMENTAL SCIENCE ASSOCIATION 216
CORRESPONDENCE.—Nitric Acid in the Vitriol Manufacture..... 216
CHEMICAL NOTICES FROM FOREIGN SOURCES..... 216
NOTES AND QUERIES.—Chlorides of Zinc 217
MEETINGS FOR THE WEEK 217

SULPHATE OF LEAD,

EAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

CERESIN (MINERAL-WAX, REFINED OZOKERIT).

Advertiser, who is thoroughly acquainted with the manufacturing of above-named article, is prepared to undertake the establishment of a manufactory of same. He also is in a position to prove that he can obtain a most beautiful product at extremely reduced cost.—Bona fide applications please direct by letter to S. 1687, at Rudolf Mosse's Foreign Advertising Agency, 1, Old Change, Cheapside, London, E.C.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,
TIPTON, STAFFORDSHIRE.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

GRIFFIN'S
CHEMICAL HANDICRAFT.
SECOND EDITION.
Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:
ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.
Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.
Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

Wanted, by a Firm in the City, a person who has been used to the analysis of sugar.—Apply to Chemicus, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Wanted, a Re-engagement as Chemist or Assistant to Analyst or Manufacturer.—Address, Azote CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Wanted, in a large City Laboratory, where there are other Assistants, a thoroughly competent Chemist accustomed to commercial and food analysis; microscopical knowledge would be a great recommendation. Unexceptionable references essential.—Address, stating age, experience, salary required, and other particulars to W., care of Mr. Boot, 7, Mark Lane, London, E.C.

ORIGINAL RESEARCH—ANNOUNCEMENT.

The long-sought for Governing Principles of Dr. Dalton's Doctrine of Definite, Reciprocal, and Multiple Proportions have been discovered: including a complete elucidation of the Governing Principles of the Substitution, Hydrogen-replacement, and Compound Radical Theories—Inorganic and Organic—of Modern Chemistry.

These original discoveries are of the highest possible interest from a scientific point of view, not only from the immense range of obscure phenomena explained, but also in pointing to new paths of enquiry and research.

A knowledge of these principles will enable the chemist to unite theory with practice: for they elucidate the most profound mysteries of his science, and explain in a lucid, clear, and intelligible manner (permitting of immediate practical verification) the fundamental principles that govern the formation of all chemical compounds, from the simplest combinations to the most complex. Due notice of publication will be advertised.—"ERBERTMA."

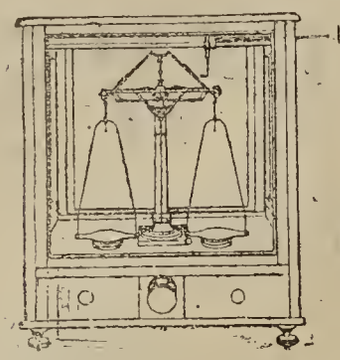
PROFESSOR HUGHES'S MICROPHONE.

This wonderful instrument may be had, with batttery, switch, and receiver complete, for One Guinea of—

HORATIO YEATES,
Optician and Philosophical Instrument Maker,
33, KING ST., COVENT GARDEN.

NOTICE TO THE TRADE.

To prevent delay and to suit the convenience of the Wholesale Newsagents the CHEMICAL NEWS *will in future be printed on Thursday night, and delivered to the trade at 9 o'clock on Friday morning.*



L. OERTLING,

TURNMILL STREET

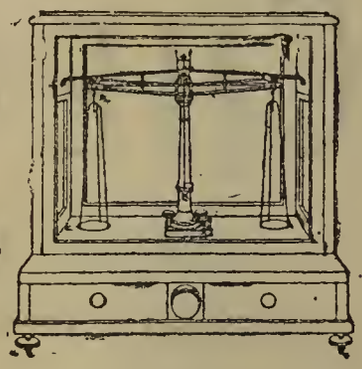
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Salt Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

MILTON CHEMICAL WORKS, STOKE-ON-TRENT, STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Special Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

CIVIL SERVICE COMMISSION.

Open Competition for Six Indexing and Abridging Clerkships in the Patent Office in London, June 18; preliminary examination in London, Edinburgh, and Dublin, June 4. Age 21 to 25.—Forms of application may be obtained at once from the Secretary.

MR. COX, VALUER OF CHEMICAL PLANT, offers his services on the usual terms. Twenty years' experience. Estimates for all description of plant, plans, &c.—Glenmohr House, New Charlton, London, S.

ASH-MILL, complete, with revolving dish, edge rollers, perforated grids, crusher, elevator, patent packing machine with revolving table, &c. Also 14-horse power horizontal engine for driving same; all nearly new; for sale very cheap, owing to want of room.—Apply to W. Pilkington and Son, Widnes, Lancashire.

To be Sold, by Private Contract, an excellent and old-established Chemical Manufacturing and Drysalting Business, together with extensive works at Manchester, Glasgow, and Ayr. The business is a very lucrative one, and is in full working order. The sole reason for selling is the death of the last surviving partner. Only principals or their solicitors will be treated with.—Apply to Slater, Heelis, and Co., Solicitors, 75, Princes Street, Manchester.

THOMAS ADKINS & CO.,

SMETHWICK,

NEAR BIRMINGHAM

MANUFACTURERS OF SPECIALLY PREPARED RED LEAD FOR FLINT-GLASS MAKING.

BISULPHIDE OF CARBON,

CHLORIDE OF SULPHUR.

GAS PURIFICATION & CHEMICAL CO., LIMITED,
161, 162, 163, PALMERSTON BUILDINGS, LONDON, E.C.

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS, LIQUOR AMMONIA, &c.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

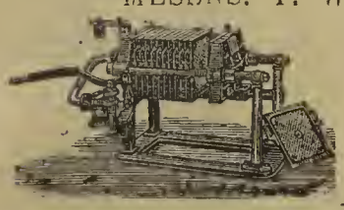
POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE
BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

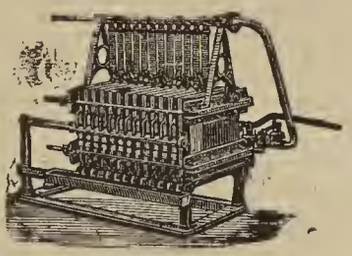
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Coal-Tar, Pitch, Creosote, Grease, Sulphate of Ammonia, Pyroligneous Acid, Acetate of Lime, Wood Naphtha, Charcoal, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

J. I. HEADLY, ENGINEER, Cambridge

Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,

89, Bishopsgate Street Within,
LONDON.

Also Agents for Prof. Wanklyn's Test Solutions for Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post free including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series of insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street, London.

TAR DISTILLERS
DRYSALTERS
BOUCK & Co LIMITED
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp Zinc, Nitric Acids &c &c.
BRIMSTONE REFINERS
Samples & prices on application.
J. I. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID, PICRIC ACID, Sal-Acetosellis BICHROME CHLORATE OF POTASH, &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

CALVERT'S CARBOLIC ACID.

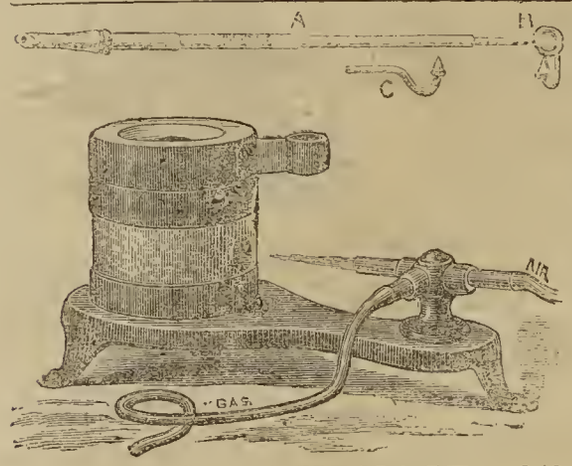
HIGHEST PRIZE MEDAL AT PARIS EXHIBITION, 1867.

GOLD AND SILVER MEDALS, HAVRE, 1868. DIPLOME D'EXCELLENCE, AMSTERDAM.

SILVER MEDAL, FIRST CLASS, NAPLES, 1871. GOLD MEDAL, MOSCOW, 1872.

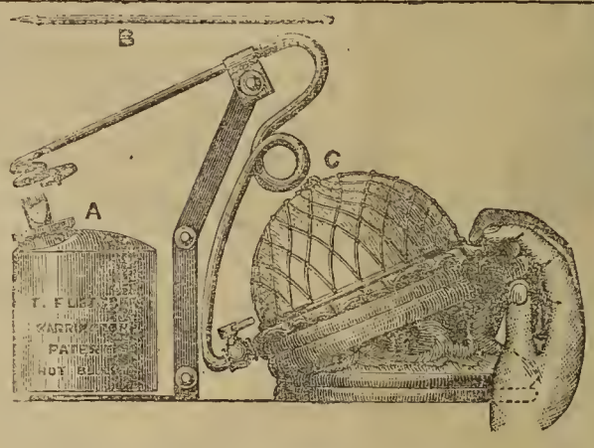
F. C. CALVERT & CO., of Bradford, Manchester (original and only Manufacturers of pure Medical Carbolic Acid), beg to inform the Trade and large Consumers that their pure Medical Carbolic as well as cheape qualities for Commercial, Veterinary, and Disinfecting Purposes, also Carbolic Acid Soaps for Medical, Toilet, and General Use, Soft Soap fo Dogs, and Carbolic Acid Disinfecting Powder, may be had from any of the below-named Wholesale Agents—

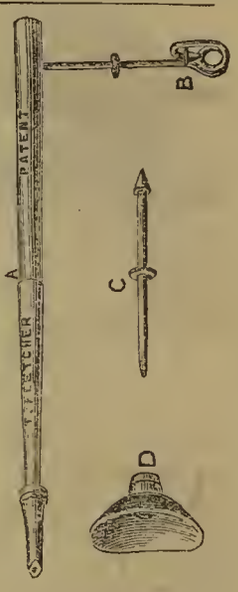
Apothecaries' Soc., Lond'n
Apothecaries' Co., Glasg'w
Apothecaries' Hall, Dublin
Allen & Hanburys
J. Bell & Co.
Barron, Harveys, & Co.
Barclay & Sons.
Burgoyne & Co.
Baiss Brothers & Co.
Barron, Squire, & Co.
Battley & Watts
Bewley & Draper
H. B. Brady
Bainbridge & Pound
Boileau & Boyd
Curling & Co.
Corbyn & Co.
Clarke, Bleasdale, & Co.
Clay, Dod, & Case
Dakin Brothers
Davy, Yates, & Co.
Duncan, Flockhart, & Co.
W. Edwards & Son
Evans, Lescher, & Evans
Evans, Sons, & Co.
Evans, Gadd, & Co.
Ferris & Co.
Glasgow New Apoth. Co.
General Apothecaries' Co.
W. & H. M. Goulding
Goodall, Backhouse, & Co.
Grimwade, Ridley, & Co.
Hodgkinsons, Stead, & Co.
Herrings & Co.
Hodgkinsons, Preston, & King
Hearon, Squire, & Francis
Hopkin & Williams
Howards & Sons
Hirst, Brooke, & Co.
W. R. Hatrick & Co.
P. Harris & Co.
Hunt & Co.
J. Ismay
Johnson & Sons
Langtons, Edden, & Hicks
Lynch & Co.
Lofthouse & Saltmer
Chas. Leslie
Maw, Son, & Thompson
H. C. Mason
W. Mather
McMaster, Hodgson, & Co.
J. F. Macfarlan & Co.
J. Mackay
R. H. Millard & Son
Mackey, Sellers, & Co.
Mottershead & Co.
Newbery & Sons
Paterson & Son
Raimes & Co.
J. Richardson & Co.
Raimes, Blanshards, & Co.
J. Reddish & Co.
Sanger & Sons
Savory & Moore.
W. Sutton & Co.
R. Sumner & Co.
James Sim & Co,
Sang & Barker
Southall, Bros., & Co.
W. Smeeton
Slinger & Barnett
P. Sandeman & Co.
Tidman & Son
Taylor, Gibson, & Co.
Thacker & Hoffe
Jas. Taylor
J. Woolley, Sons, & Co
Wyleys & Co.
Wilson & Kitchen
C. H. Warner & Co.
A. & J. Warren
Walkington & Son
Wright, Layman, & Umney



A SIMPLE FURNACE. 8/6.

Will melt 8 ozs. Gold, Cast-Iron, &c., in a few minutes. Can be used for cupelling or roasting, and the burner for glass-blowing, brazing, &c.





Fletcher's Patent Hot and Cold Blast Blowpipes. *Prices from* 1*s.*

ILLUSTRATED LIST ON APPLICATION.

THOS. FLETCHER, MUSEUM STREET, WARRINGTON.

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

MANUFACTURERS OF

PURE CARBOLIC ACID, Cryst. at 42°·2 C. } Discovered by C. Lowe.
,, ,, do. Hydrate of
MEDICINAL do. Cryst. at 35° C.
COMMERCIAL do. No. 1 ,, 35° C.
,, do. 2 ,, 29° C.
,, do. 3 ,, 12° C.
,, do. 4 liquid at 0° C.
CARBOLIC ACID DISINFECTING POWDER.

CARBOLIC ACID GLYCERINE SOLUTIONS.
CRESYLIC ACID.
SULPHO-PHENIC ACID (CRYST.
SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.

BENZOL (Cryst.).
ANTHRACENE.
NAPHTHALINE.
PICRIC ACID (Crystal and Paste).
AURINE (Rosolic Acid) Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

JOHN CLIFF, STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
IMPERIAL POTTERIES, LAMBETH.

OLD QUAY RUNCORN.

London Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court Ludgate Hill, E C
May 2 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S. (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") *Established Twenty-six Years.*

Vol. 37.—No. 966. *Copyright reserved.* Friday, May 31, 1878. *Registered as a Newspaper.* PRICE, 4*d.* POST FREE, 4½*d.*

CONTENTS.

ARTICLES:— PAGE
Hofmann's Method for the Determination of Vapour Densities, by William A. Tilden 219
A Process for Coating Iron with Magnetic Oxide by the Action of Heated Air, by George R. Tweedie 220
Some Remarks on the Preparation of Steel Plates from Bessemer Ingots, by Sergius Kern, M.E 220
Synthesis of Phthalic Acid, by Mr. A. Guyard 220
Improvements in the Method of Preserving Annimal and Vegetable Food 221
PROCEEDINGS OF SOCIETIES:—
PHYSICAL SOCIETY.—Brass Wind Instruments as Resonators.... 222
MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.—Note on the Occurrence of Dioptase on Chrysocolla from Peru—On Indigo-Blue from *Polygonum tinctorium* and other Plants—The Estimation of Hyposulphites and Sulphites—Action of Iodine Trichloride upon Carbon Bisulphide..... 223
NOTICES OF BOOKS 225
CORRESPONDENCE.—The Eudiometric Analysis of Mixtures of Paraffins—Analyses of Steel 226
CHEMICAL NOTICES FROM FOREIGN SOURCES..... 227

SULPHATE OF LEAD,

EAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

PROFESSOR HUGHES'S MICROPHONE.

This wonderful instrument may be had, with batttery, switch, and receiver complete, for One Guinea of—

HORATIO YEATES,

Optician and Philosophical Instrument Maker,

33, KING ST., COVENT GARDEN.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,

TIPTON, STAFFORDSHIRE.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

GRIFFIN'S

CHEMICAL HANDICRAFT.

SECOND EDITION.

Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:

ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.

Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.

Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

Wanted, a Re-engagement as Chemist or Assistant to Analyst or Manufacturer.—Address, Azote CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

TO TAR DISTILLERS.

About 20,000 Gallons Black Oil from Bones to be disposed of quarterly. Rail or Canal from London. Buyer to find casks. Tenders at cash price per gallon to be made to Delta, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

ORIGINAL RESEARCH—ANNOUNCEMENT.

The long-sought for Governing Principles of Dr. Dalton's Doctrine of Definite, Reciprocal, and Multip Proportions have been discovered: including a complete elucidatio of the Governing Principles of the Substitution, Hydrogen-replacement, and Compound Radical Theories—Inorganic and Organic—of Modern Chemistry.

These original discoveries are of the highest possible interest from a scientific point of view, not only from the immense range of obscure phenomena explained, but also in pointing to new paths of enquiry and research.

A knowledge of these principles will enable the chemist to unite theory with practice: for they elucidate the most profound mysteries of his science, and explain in a lucid, clear, and intelligible manner (permitting of immediate practical verification) the fundamental principles that govern the formation of all chemical compounds, from the simplest combinations to the most complex. Due notice of publication will be advertised.—"ERBERTMA."

MACTEAR'S PATENT CARBONATING FURNACE,

AND

JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,

MANUFACTURED BY

R. DAGLISH & CO.,

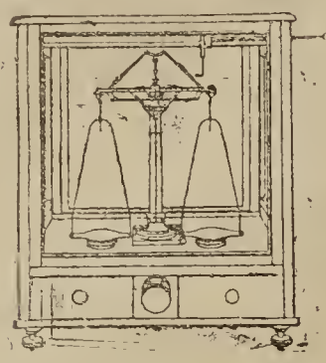
ST. HELEN'S ENGINE ANL BOILER WORKS,

LANCASHIRE.

Prices and other particulars on application.

NOTICE TO THE TRADE.

To prevent delay and to suit the convenience of the Wholesale Newsagents the CHEMICAL NEWS *will in future be printed on Thursday night, and delivered to the trade at 9 o'clock on Friday morning.*



L. OERTLING,

TURNMILL STREET

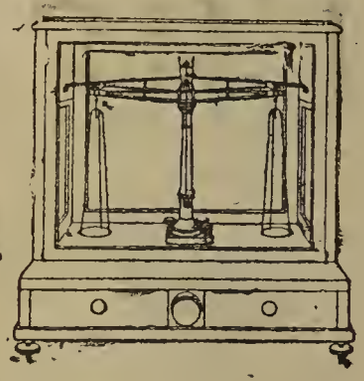
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal- Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

MILTON CHEMICAL WORKS, STOKE-ON-TRENT, STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

---

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street E.C. who hold stock ready for delivery.

MR. COX, VALUER OF CHEMICAL PLANT, offers his services on the usual terms. Twenty years' experience. Estimates for all description of plant, plans, &c.—Glenmohr House, New Charlton, London, S.

To be Sold, by Private Contract, an excellent and old-established Chemical Manufacturing and Drysalting Business, together with extensive works at Manchester, Glasgow, and Ayr. The business is a very lucrative one, and is in full working order. The sole reason for selling is the death of the last surviving partner. Only principals or their solicitors will be treated with.—Apply to Slater, Heelis, and Co., Solicitors, 75, Princes Street, Manchester.

THOMAS ADKINS & CO.,

SMETHWICK,

NEAR BIRMINGHAM

MANUFACTURERS OF SPECIALLY PREPARED RED LEAD FOR FLINT-GLASS MAKING.

BISULPHIDE OF CARBON,

CHLORIDE OF SULPHUR.

GAS PURIFICATION & CHEMICAL CO., LIMITED,
161, 162, 163, PALMERSTON BUILDINGS, LONDON, E.C.

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS, LIQUOR AMMONIA, &c.

JAMES WOOLLEY, SONS, & CO.

69, MARKET STREET, MANCHESTER,

DEALERS IN

CHEMICAL AND SCIENTIFIC APPARATUS CHEMICAL REAGENTS, &c.,

FOR THE USE OF

ANALYSTS, SCIENCE TEACHERS, AND MANUFACTURERS

Price Lists on application

A. BOAKE & CO.,

STRATFORD, LONDON, E.,

MAKERS OF

THE SULPHITES AND BISULPHITES

OF

SODA AND LIME.

Lately published, in one vol. of 1091 pages, with Diagrams and other Illustrations. 8vo. £1 11s. 6d.

EXPERIMENTAL RESEARCHES IN PURE, APPLIED, AND PHYSICAL CHEMISTRY.

By E. FRANKLAND, Ph.D. (Marburg), D.C.L., F.R.S., Professor of Chemistry in the Royal School of Mines, &c.

The work includes investigations on the Manufacture and Illuminating Power of Gas, on the Water Supply of Towns, and the Purification of Drainage from Towns and Manufactories.

Also by Professor FRANKLAND,

LECTURE NOTES FOR CHEMICAL STUDENTS. Second Edition. Vol. I. (Inorganic), 4s. Vol. II. (Organic), 5s.

London: J. VAN VOORST 1, Paternoster Row.

A Chemist, who has had some years' experience in large iron and steel works, desires a Re-engagement.—Address, C., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

A German Chemist, who acquired English during an eight months' residence in London after having completed his studies at the Gewerbe Akademie in Berlin, and who is provided with good testimonials, desires a Situation in an establishment or a laboratory in England from 1st August next.—Address, R. Schoeller, 43, Mark Lane, E.C., Liebig's Extract of Meat Co., Lim.

Assistant wanted in an Analytical Laboratory in London. He must be competent to undertake analyses of various commercial samples and foods. First class references required.—Apply by letter, stating age, previous engagements, salary, &c., to H. G., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

MICROSCOPE AND POLARISCOPE IN BREWING.

The Advertiser desires to meet with a Gentleman who has practical knowledge of the above, especially of the more recent discoveries of Pasteur and of our English microscopists.—Address, Yeast, CHEMICAL NEWS Office, Boy Court, Ludgate Hill London, E.C.

TO FOREMEN AND OTHERS.

Wanted, in a Chemical Factory, an intelligent man who has had practical experience in the manufacture of Citric Acid.—Apply, stating full particulars, to Chemicus, 18, Caledonian Terrace Dalry, Edinburgh.

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy. "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

PROFESSOR HUGHES'S MICROPHONE.

Six Daniell Cells and Materials for Constructing Microphone for 21s.; carriage paid to any part of England. Telephones fixed or exhibited. Electric Bells, and all descriptions of Electrical Apparatus for Telegraph and for Experimental Purposes. —Edward Paterson, Electrical Engineer, 3, Bedford Court, Covent Garden, W.C.

THE NEW MINIATURE SPRENGEL PUMP.
(STEARN AND SWAN'S PATENT.)

As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

PROF. HUGHES'S MICROPHONE,
Price 10/6, 15/, 21/.

The 10s. 6d. is a neat instrument in polished mahogany case for the table or pocket.

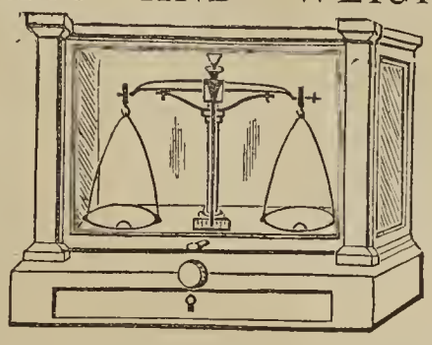
The 15s. is a more sensitive instrument. It will magnify delicate sounds, and render audible sounds, such as the tramp of a fly in walking.

The 21s. instrument include a 3-cell battery and 10 yards of conducting wire.

M. JACKSON & CO.,
65, BARBICAN, LONDON, E.C.
SCIENTIFIC APPARATUS MANUFACTURERS.

Price Lists 3d. and 1s. each.

BECKER & SONS,
MANUFACTURERS OF
CHEMICAL AND GOLD ASSAY BALANCES
AND OTHER
SCALES AND WEIGHTS.

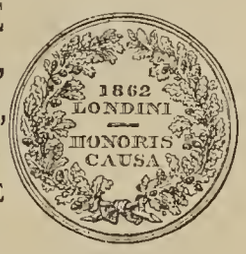
ROTTERDAM.  NEW YORK.

BECKER'S STUDENT'S BALANCE, in polished mahogany glass case, sliding front, counterpoised, to carry 30 grammes in each pan and turn to ½ milligramme, nickel plated pans.. £2 10
Ditto, ditto, in mahogany glass case, polished black £2 13

Sole Agents for England, Ireland, and Wales:—
TOWNSON & MERCER,

Becker's Complete Lists forwarded by post on receipt of 1d. stamp, or free on application.

BISULPHIDE OF CARBON,
PROTOSULPHATE,
RED OXIDE
OXYCHLORIDE
Sulphocyanide,
And every other Mercurial Preparation.



BISULPHITE OF LIME, TETRACHLORIDE OF CARBON,
Oxysulphuret of Antimony, Glacial Acetic Acid,

LIQUOR AMMONIÆ,
SULPHIDE OF IRON,
PURE ACIDS,
CHLORIDE OF SULPHUR,
ACETONE,
CHLOROFORM,
ALDEHYDE,
CHLORATE BARYTA,
ARSENIC ACIDS,
FRUIT ESSENCES FOR CONFECTIONERY & LIQUEURS,
PERCHLORIDE OF IRON,
SULPHITE AND HYPOSULPHITE OF SODA,
PHOSPHATES OF SODA AND AMMONIA,
ETHERS,
BROMIDES,
IODIDES,
SCALE AND GRANULAR PREPARATIONS.

ALSO,
Pure Photographic Chemicals of every kind.
MANUFACTURED BY
WILLIAM BAILEY & SON,
HORSELEY FIELDS CHEMICAL WORKS,
WOLVERHAMPTON

CARBOYS.
THE PATENT CARBOY CO., MANCHESTER.

The advantage of the above Carboys is that in consequence of the packing it is almost impossible for them to get broken in transit, and the railway companies are prepared to carry them at low rates. They are most valuable for shipping purposes, and also for packing gunpowder. For prices and full particulars apply to the Agents—

F. S. BAYLEY and CO., Chemical and Commission Agents, 88, King Street, Manchester.

TO BE SOLD.—An Acetate Soda, Naphtha, and Charcoal Works in Glamorganshire. Close to Railway Stations; abundance of water and wood: a going concern; price about £2500.—A. B. C., 163, Junction Road, London.

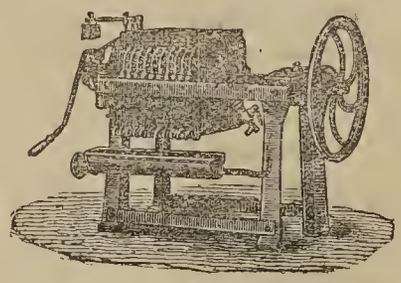
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

THE speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing rare Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for tudents, Schools, Colleges, &c.
NEW PATTERNS OF GEOLOGICAL HAMMERS.
NEW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
88, CHARLOTTE STREET, FITZROY SQUARE

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester

SPECIALITIES.

MANGANESE	Lump, Crystallised, Ground, and Prepa ed Large stock of every description. *** *Suitable for all Trades.*
ARSENIC	Refined powdered, Lump, Grey, and Ruby.
FLUOR-SPAR	Finest produced. Medium and Common for al purposes.
BARYTES	Carbonate and Sulphate. All qualities of Lump and Ground.
BAUXITE	Of high percentage of Alumina and low in Iron

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove and the cleanliness of application makes this one of the marvels o household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal P lytechnic Institution.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.

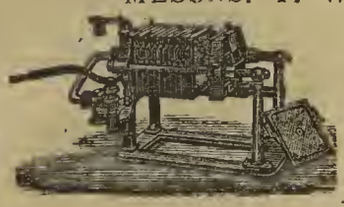
SULPHATE OF AMMONIA, ANTHRACENE
BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

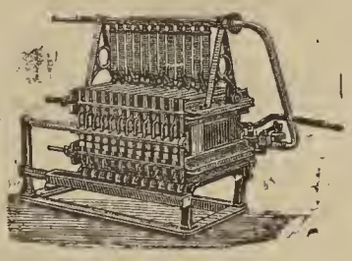
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Coal-Tar, Pitch, Creosote, Grease, Sulphate of Ammonia, Pyroligneous Acid, Acetate of Lime, Wood Naphtha, Charcoal, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

J. I. HEADLY, ENGINEER, Cambridge

Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Also Agents for Prof. Wanklyn's Test Solutions for Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post free including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series of insertions.

Cheques and Post-Office Orders, crossed "London and Count Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street, London.

TAR DISTILLERS
DRYSALTERS
BOUCK & Co LIMITED
MILES PLATTING, MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia, PITCH & CREOSOTE, SULPHATE OF COPPER, VITRIOL, Nitrate Lead, Sulp. Zinc, Nitric Acids, &c. &c.
BRIMSTONE REFINERS
Samples & prices on application.
J. I. VAUGHAN Secretary
AGENTS FOR Best Scotch & English, RED & YELLOW PRUSSIATE, OXALIC ACID, PICRIC ACID, Sal-Acetosella, BICHROME, CHLORATE OF POTASH, &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

DOULTON & WATTS

HIGH STREET, LAMBETH, LONDON, S.E.

DEPOTS:—GRANVILLE WHARF, WOOD STREET, BIRMINGHAM; 100, SOHO STREET LIVERPOOL; AND 18, RUE MARTEL, PARIS.

MANUFACTURERS OF

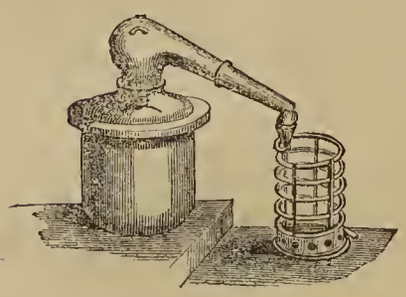
STILLS, RETORTS, CONDENSING WORMS, WOLLF'S BOTTLES.

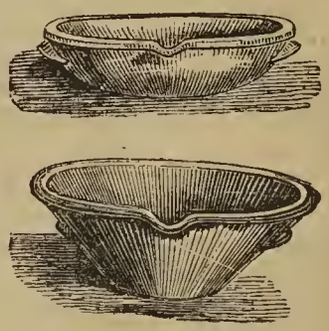
ACID PUMPS, COCKS, PERCOLATORS, AIR-TIGHT JARS,

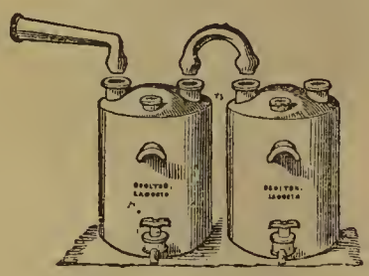
AND EVERY DESCRIPTION OF

STONEWARE FOR CHEMICAL PURPOSES,

Warranted to Resist the Strongest Acids.







PLUMBAGO CRUCIBLES, AND OTHER IRE-STANDING GOODS.

CHEMISTS' AND DRUGGISTS' GLASS. PORCELAIN TAPS.

PRICE LISTS of any of the above, and of Every Description of Stoneware, may be had on application, and Samples seen at

Messrs. D. and W.'s SHOW ROOMS, HIGH STREET, LAMBETH.

ROYAL POLYTECHNIC.—THE SIEGE OF TROY has been reproduced, with new Scenery and Effects; rendered by Mr. Lin Rayne, supported by an efficient Staff.—THE CHEMISTRY OF THE SUN, by Prof. Pepper.—CLAY AND THE POTTER, by Prof. Gardner.—MODERN GUNS AND PROJECTILES, by Mr. J. L. King.—CLEOPATRA'S NEEDLE by Mr. W. R. May.—BULGARIA, by Mr. E. Wilkie.—Dr. SAMUEL JOHNSON AND HIS FRIENDS, by Dr. Aveling.—THE TELEPHONE, THE OXY-HYDROGEN MICROSCOPE, and TORPEDOES, by Mr. King.—HAYLING ISLAND, WHERE IT IS AND ALL ABOUT IT, by Mr. J. L. King.—Admission to the whole, 1s.; Schools and Children under Ten, 6d. Reserved Stalls (including Admission), 2s. 6d. Open at 12 and 7; Carriages at 5 and 10

Just published, 2nd Edition, 594 pp., 8vo., price 12s. 6d.

ORGANIC MATERIA MEDICA.

BY DR. MUTER.

Analytical Chemists will find this a concise and yet complete book of reference for the isolation and examination of the active principles of drugs. Special appendix on the microscopic characters of the starches in food and drugs. Copious index and qualitative courses for resins, &c.

Published by W. BAXTER at the Office of the South London Schoo of Pharmacy, Kennington Cross, S.E., and sold by Messrs. Simpkin and Marshall and Messrs. Baillière, Tindal, and Cox.

FACTORIES: Reddish and Bradford, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

MANUFACTURERS OF

PURE CARBOLIC ACID, Cryst. at 42°·2 C.	Discovered by C. Lowe.		CARBOLIC ACID GLYCERINE SOLUTIONS.	BENZOL (Cryst.).
,, ,, do. Hydrate of			CRESYLIC ACID.	ANTHRACENE.
MEDICINAL do. Cryst. at 35° C.			SULPHO-PHENIC ACID (CRYST.	NAPHTHALINE.
COMMERCIAL do. No. 1 ,, 35° C.			SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.	PICRIC ACID (Crystal and Paste).
,, do. 2 ,, 29° C.				AURINE (Rosolic Acid) Cake and Solution.
,, do. 3 ,, 12° C.				
,, do. 4 liquid at 0° C.				
CARBOLIC ACID DISINFECTING POWDER.				

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesa and Export Houses.

JOHN CLIFF, STONEWARE MANUFACTURER, Late JOHN CLIFF & Co. Formerly STEPHEN GREEN. IMPERIAL POTTERIES, LAMBETH. OLD QUAY RUNCORN.

London rinted and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court Ludgate Hill, E C
May 31, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S. (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") *Established Twenty-six Years.*

Vol. 37.—No. 967. *Copyright reserved.* Friday, June 7, 1878. *Registered as a Newspaper.* PRICE, 4*d.* POST FREE, 4½*d.*

CONTENTS.

ARTICLES:— PAGE

Colour-Comparator for Quantitative Analysis, by Prof. Albert R. Leeds 229
A Study of Plat-Ammonia Compounds, by Samuel E. Phillips .. 231
Note on Urea and Crenate of Ammonia in Spring-waters, by Dr. T. L. Phipson, F.C.S..... 233
Composition and Quality of the Metropolitan Water..... 236
NOTICES OF BOOKS.—Industrial Chemistry—Common Sense for Gas Users 234
CORRESPONDENCE.—Detection and Estimation of Free Mineral Acid in Sulphate of Alumina 237
CHEMICAL NOTICES FROM FOREIGN SOURCES..... 237
MISCELLANEOUS.—Soirée of the Chemical Society 238

SULPHATE OF LEAD,

EAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

A Chemist, who has had some years' experience in large iron and steel works, desires a Re-engagement.—Address, C., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

PROFESSOR HUGHES'S MICROPHONE.

This wonderful instrument may be had, with batttery, switch, and receiver complete, for One Guinea of—

HORATIO YEATES,

Optician and Philosophical Instrument Maker,

33, KING ST., COVENT GARDEN.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,

TIPTON, STAFFORDSHIRE.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street Glasgow.

GRIFFIN'S

CHEMICAL HANDICRAFT.

SECOND EDITION.

Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:

ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.

Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.

Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

A Young Gentleman (aged 21) seeks an Engagement as Chemist or Assistant in a Works. Has studied chemistry for three years.—Address, M., care of Mr. Henley, 6, Willow Terrace, Canonbury, London, N.

Wanted, by the Editor of a Technical Work, an Assistant capable of writing clearly and correctly. He must have had a scientific education, and should possess a knowledge of German.—Apply by letter only, stating qualifications and remuneration expected, to A.B., 46, Charing Cross, London.

Wanted, a Disintegrator suitable for mixing and grinding manure.—Apply, stating size and lowest price, to James Page, Palmerston Street, Manchester.

Wanted, a Situation by a Chemist (aged 19), who has practically studied general analysis for three years.—Address, F. W. Richardson, M. D. Penney, Esq., F.C.S., Analytical Laboratory, 15, High Street, Hull.

Wanted, a Re-engagement as Chemist or Assistant to Analyst or Manufacturer.—Address, Azote, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

ORIGINAL RESEARCH—ANNOUNCEMENT.

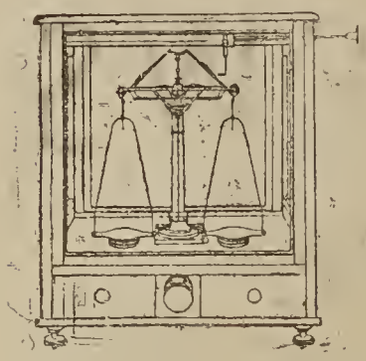
The long-sought for Governing Principles of Dr. Dalton's Doctrine of Definite, Reciprocal, and Multiple Proportions have been discovered: including a complete elucidation of the Governing Principles of the Substitution, Hydrogen-replacement, and Compound Radical Theories—Inorganic and Organic—of Modern Chemistry.

These original discoveries are of the highest possible interest from a scientific point of view, not only from the immense range of obscure phenomena explained, but also in pointing to new paths of enquiry and research.

A knowledge of these principles will enable the chemist to unite theory with practice: for they elucidate the most profound mysteries of his science, and explain in a lucid, clear, and intelligible manner (permitting of immediate practical verification) the fundamental principles that govern the formation of all chemical compounds, from the simplest combinations to the most complex. Due notice of publication will be advertised.—"ERBERTMA."

NOTICE TO THE TRADE.

To prevent delay and to suit the convenience of the Wholesale Newsagents the CHEMICAL NEWS *will in future be printed on Thursday night, and delivered to the trade at 9 o'clock on Friday morning.*



L. OERTLING,

TURNMILL STREET

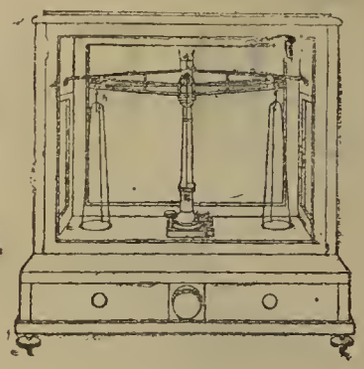
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

Established 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY

LANCASHIRE.

MILTON CHEMICAL WORKS,

STOKE-ON-TRENT,

STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

---

BISULPHITE OF LIME.

BISULPHITE OF SODA.

WILLIAM MARRIOTT

CHEMICAL WORKS HUDDERSFIELD

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower et E.C. who hold stock ready for delivery.

THOMAS ADKINS & CO.,

SMETHWICK,

NEAR BIRMINGHAM

Manufacturers of Specially Prepared Red Lead for Flint-Glass Making.

BISULPHIDE OF CARBON,

CHLORIDE OF SULPHUR.

GAS PURIFICATION & CHEMICAL CO., LIMITED,

161, 162, 163, Palmerston Buildings, London, E.C.

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS, LIQUOR AMMONIA, &c.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,

LABORATORY FURNISHERS,

7, Exchange Street and 10, Half Moon Street,

MANCHESTER

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy. "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

---

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

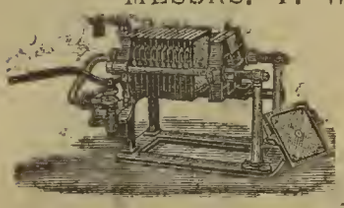
POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE
BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

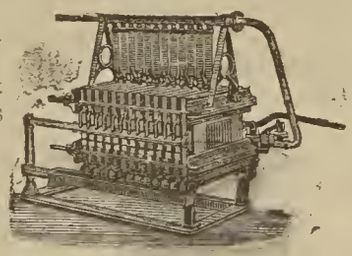
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.
And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Coal-Tar, Pitch, Creosote, Grease, Sulphate of Ammonia, Pyroligneous Acid, Acetate of Lime, Wood Naphtha, Charcoal, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

J. I. HEADLY, ENGINEER, Cambridge
Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Also Agents for Prof. Wanklyn's Test Solutions for Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

THE CHEMICAL NEWS

AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post free including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series of insertions.

Cheques and Post-Office Orders, crossed "London and Count Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street, London.

TAR DISTILLERS
DRYSALTERS
BOUCK & CO LIMITED
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp. Zinc. Nitric Acids, &c. &c
BRIMSTONE REFINERS
Samples & prices on application.
J. J. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID. PICRIC ACID. Sal-Acetosella BICHROME CHLORATE OF POTASH. &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

CALVERT'S CARBOLIC ACID.

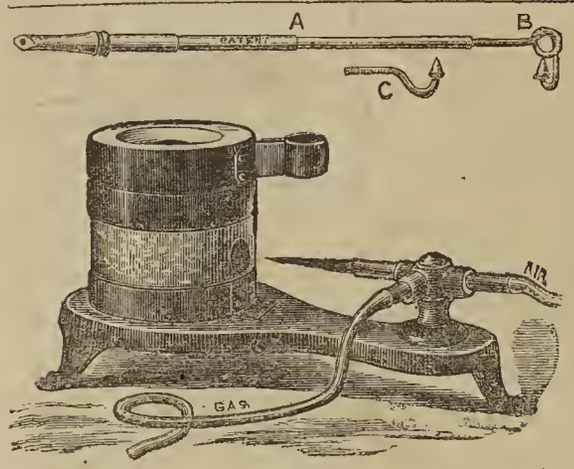
HIGHEST PRIZE MEDAL AT PARIS EXHIBITION, 1867.

GOLD AND SILVER MEDALS, HAVRE, 1868. DIPLOME D'EXCELLENCE, AMSTERDAM.

SILVER MEDAL, FIRST CLASS, NAPLES, 1871. GOLD MEDAL, MOSCOW, 1872.

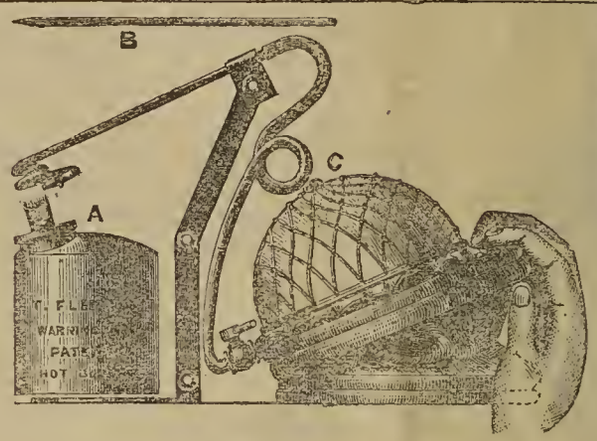
F. C. CALVERT & CO., of Bradford, Manchester (original and only Manufacturers of pure Medical Carbolic Acid), beg to inform the Trade and large Consumers that their pure Medical Carbolic as well as cheaper qualities for Commercial, Veterinary, and Disinfecting Purposes, also Carbolic Acid Soaps for Medical, Toilet, and General Use, Soft Soap for Dogs, and Carbolic Acid Disinfecting Powder, may be had from any of the below-named Wholesale Agents—

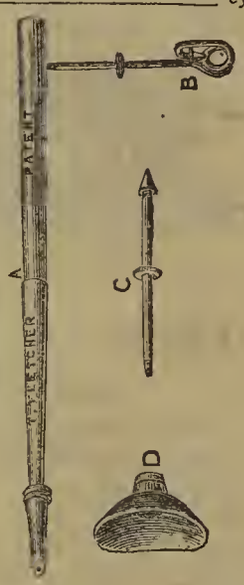
Apothecaries' Soc., Lond'n
Apothecaries' Co , Glasg'w
Apothecaries' Hall, Dublin
Allen & Hanburys
J. Bell & Co.
Barron, Harveys, & Co.
Barclay & Sons.
Burgoyne & Co.
Baiss Brothers & Co.
Barron, Squire, & Co.
Battley & Watts
Bewley & Draper
H. B. Brady
Bainbridge & Pound
Boileau & Boyd
Curling & Co.
Corbyn & Co.
Clarke, Bleasdale, & Co.
Clay, Dod, & Case
Dakin Brothers
Davy, Yates, & Co.
Duncan, Flockhart, & Co.
W. Edwards & Son
Evans, Lescher, & Evans
Evans, Sons, & Co.
Evans, Gadd, & Co.
Ferris & Co.
Glasgow New Apoth. Co.
General Apothecaries' Co.
W. & H. M. Goulding
Goodall, Backhouse, & Co.
Grimwade, Ridley, & Co.
Hodgkinsons, Stead, & Co.
Herrings & Co.
Hodgkinsons, Preston, & King
Hearon, Squire, & Francis
Hopkin & Williams
Howards & Sons
Hirst, Brooke, & Co.
W. R. Hatrick & Co.
P. Harris & Co.
Hunt & Co.
J. Ismay
Johnson & Sons
Langtons, Edden, & Hicks
Lynch & Co.
Lofthouse & Saltmer
Chas. Leslie
Maw, Son, & Thompson
H. C. Mason
W. Mather
McMaster, Hodgson, & Co.
J. F. Macfarlan & Co.
J. Mackay
R. H. Millard & Son
Mackey, Sellers, & Co.
Mottershead & Co.
Newbery & Sons
Paterson & Son
Raimes & Co.
J. Richardson & Co.
Raimes, Blanshards, & Co.
J Reddish & Co.
Sanger & Sons
Savory & Moore.
W. Sutton & Co.
R. Sumner & Co.
James Sim & Co,
Sang & Barker
Southall, Bros., & Co.
W. Smeeton
Slinger & Barnett
P. Sandeman & Co.
Tidman & Son
Taylor, Gibson, & Co.
Thacker & Hoffe
Jas. Taylor
J. Woolley, Sons, & Co
Wyleys & Co.
Wilson & Kitchen
C. H. Warner & Co.
A. & J. Warren
Walkington & Son
Wright, Layman, & Umney



A SIMPLE FURNACE. 7/6.

Will melt 8 ozs. Gold, Cast-Iron, &c., in a few minutes. Can be used for cupelling or roasting, and the burner for glass-blowing, brazing, &c.





Fletcher's Patent Hot and Cold Blast Blowpipes. *Prices from* 1s.

ILLUSTRATED LIST ON APPLICATION.

THOS. FLETCHER, MUSEUM STREET, WARRINGTON.

FACTORIES: Reddish and Bradfoid, MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

TOWN OFFICES: 61, Piccadilly, MANCHESTER.

MANUFACTURERS OF

PURE CARBOLIC ACID, Cryst. at 42°·2 C. } Discovered by C. Lowe.
,, ,, do. Hydrate of }
MEDICINAL do. Cryst. at 35° C.
COMMERCIAL do. No. 1 ,, 35° C.
,, do. 2 ,, 29° C.
,, do. 3 ,, 12° C.
,, do. 4 liquid at 0° C.
CARBOLIC ACID DISINFECTING POWDER.

CARBOLIC ACID GLYCERINE SOLUTIONS.
CRESYLIC ACID.
SULPHO-PHENIC ACID (CRYST.
SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.

BENZOL (Cryst.).
ANTHRACENE.
NAPHTHALINE.
PICRIC ACID (Crystal and Paste).
AURINE (Rosolic Acid Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesal and Export Houses.

JOHN CLIFF, STONEWARE MANUFACTURER, Late JOHN CLIFF & Co. Formerly STEPHEN GREEN. No. 5 IMPERIAL POTTERIES, LAMBETH. OLD QUAY RUNCORN.

London Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court Ludgate Hill, E C
June 7, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S. (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") *Established Twenty-six Years.*

Vol. 37.—No. 968. *Copyright reserved.* Friday, June 14, 1878. *Registered as a Newspaper.* PRICE, 4*d.* POST FREE, 4½*d.*

CONTENTS.

ARTICLES:— PAGE
On Areometers, by P. Casamajor 241
Some Reactions with Lindo's Test for some of the Bases in Opium, by Prof. How..... 244
PROCEEDINGS OF SOCIETIES:—
CHEMICAL SOCIETY.—Analogies between the Action of the Copper-zinc Couple and Occluded and Nascent Hydrogen—On the Alkaloids of the Aconites—On the Alkaloids of *Veratrum Sabadilla*—On the Action of Hydrochloric Acid upon Chemical Compounds—On the Action of Oxides on Salts—A New Test for Glycerin—Ammonium Tri-iodide 245
PHYSICAL SOCIETY.—Physical Action of the Microphone—Electrical Properties of Bees'-wax and Lead Chloride..... 246
NOTICES OF BOOKS 248
CHEMICAL NOTICES FROM FOREIGN SOURCES..... 250

SULPHATE OF LEAD,

EAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

PROFESSOR HUGHES'S MICROPHONE.

This wonderful instrument may be had, with batttery, switch, and receiver complete, for One Guinea of—

HORATIO YEATES,

Optician and Philosophical Instrument Maker,

33, KING ST., COVENT GARDEN.

Chemist (26) desires Situation from 1st August, or after, in Sugar Refinery or other Works, in Scotland. Good Certificates.—Address Chemicus, care of Mr. Main, 10, Livingstone Place, Edinburgh, N.B.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,

TIPTON, STAFFORDSHIRE.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 39, Union Street, Glasgow.

GRIFFIN'S

CHEMICAL HANDICRAFT.

SECOND EDITION.

Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:

ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.

Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.

Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

ROYAL COLLEGE OF CHEMISTRY

SOUTH KENSINGTON MUSEUM.

Wanted, to Assist in the Instruction of Students in research and the higher branches of chemical analysis, a Gentleman who must be the author of at least one original investigation of merit, and who has spent at least two years in foreign laboratories. A Graduate of an English University preferred. A liberal salary will be given to a thoroughly competent man.—Apply by letter, stating particulars, to Dr. Frankland, at the above address.

HARRIS'S PATENT SELF-ACTING STEAM

Pressure-Regulating Valve, for ensuring an absolutely exact lower pressure of steam, unaffected by fluctuations in the boiler-pressure. Prices on application.—Address, Mr. J. Harris, C.E., Ross; or at 83, Fairfield Road, London.

A Manager of Alkali Works, of long experience, is open to an Engagement. Has been largely employed in Plant Erection, and has given particular attention to the making out of Process Costs.—Address, Manager, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Wanted, a Situation by an Analyst (aged 19), who has practically studied general analysis for three years.—Address, F. W. Richardson, M. D. Penney, Esq., F.C.S., Analytical Laboratory, 15, High Street, Hull.

MACTEAR'S PATENT CARBONATING FURNACE,

AND

JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,

MANUFACTURED BY

R. DAGLISH & CO.,

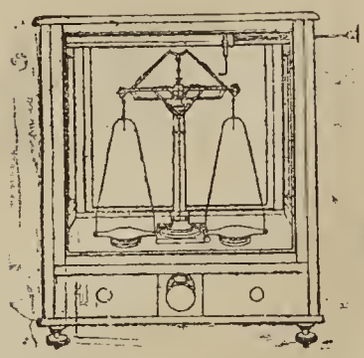
ST. HELEN'S ENGINE AND BOILER WORKS,

LANCASHIRE.

Prices and other particulars on application.

NOTICE TO THE TRADE.

To prevent delay and to suit the convenience of the Wholesale Newsagents the CHEMICAL NEWS *will in future be printed on Thursday night, and delivered to the trade at 9 o'clock on Friday morning.*



L. OERTLING,

TURNMILL STREET

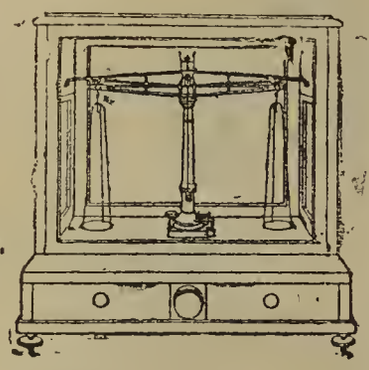
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

Established 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

MILTON CHEMICAL WORKS, STOKE-ON-TRENT, STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Special Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

---

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street, E.C., who hold stock ready for delivery.

THOMAS ADKINS & CO.,

SMETHWICK,

NEAR BIRMINGHAM

Manufacturers of Specially Prepared Red Lead for Flint-Glass Making.

BISULPHIDE OF CARBON,

CHLORIDE OF SULPHUR.

GAS PURIFICATION & CHEMICAL CO., LIMITED,
161, 162, 163, Palmerston Buildings, London, E.C.

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS, LIQUOR AMMONIA, &c.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy. "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

---

A. BOAKE & CO.,

STRATFORD, LONDON, E.,

MAKERS OF

THE SULPHITES AND BISULPHITES

OF

SODA AND LIME.

PROFESSOR HUGHES'S MICROPHONE.

Six Daniell Cells and Materials for Constructing Microphone for 21s.; carriage paid to any part of England. Telephones fixed or exhibited. Electric Bells, and all descriptions of Electrical Apparatus for Telegraph and for Experimental Purposes. —Edward Paterson, Electrical Engineer, 3, Bedford Court, Covent Garden, W.C.

A Firm of Manufacturing Chemists, having spare capital and portion of premises unemployed, are willing to enter into arrangements to add further manufactures to their business. There are several tanks available, and a plentiful supply of water and steam.—Address, in full confidence, to X. Y. Z., care of Mr. Jones, Operative Chemist, 386, Kingsland Road, London.

To be Sold, by Private Contract, an excellent and old-established Chemical Manufacturing and Drysalting Business, together with extensive works at Manchester, Glasgow, and Ayr. The business is a very lucrative one, and is in full working order. The sole reason for selling is the death of the last surviving partner. Only principals or their solicitors will be treated with.—Apply to Slater, Heelis, and Co., Solicitors, 75, Princes Street, Manchester.

MR. COX, VALUER OF CHEMICAL PLANT, offers his services on the usual terms. Twenty years' experience. Estimates for all description of plant, plans, &c.—Glenmohr House, New Charlton, London, S.

PROF. HUGHES'S MICROPHONE,

Price 10/6, 15/, 21/.

The 10s. 6d. is a neat instrument in polished mahogany case for the table or pocket.

The 15s. is a more sensitive instrument. It will magnify delicate sounds, and render audible sounds, such as the tramp of a fly in walking.

The 21s. instrument include a 3-cell battery and 10 yards of conducting wire.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

SCIENTIFIC APPARATUS MANUFACTURERS.

Price Lists 3d. and 1s. each.

SPECIALITIES.

MANGANESE Lump, Crystallised, Ground, and Prepared Large stock of every description. *** *Suitable for all Trades.*

ARSENIC Refined powdered, Lump, Grey, and Ruby.

FLUOR-SPAR Finest produced. Medium and Common for all purposes.

BARYTES Carbonate and Sulphate. All qualities of Lump and Ground.

BAUXITE Of high percentage of Alumina and low in Iron:

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,

5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

ROYAL POLYTECHNIC.—THE SIEGE OF TROY has been reproduced, with new Scenery and Effects; rendered by Mr. Lin Rayne, supported by an efficient Staff.—THE CHEMISTRY OF THE SUN, by Prof. Pepper.—CLAY AND THE POTTER, by Prof. Gardner.—MODERN GUNS AND PROJECTILES, by Mr. J. L. King.—CLEOPATRA'S NEEDLE by Mr. W. R. May.—BULGARIA, by Mr. E. Wilkie.—Dr. SAMUEL JOHNSON AND HIS FRIENDS, by Dr. Aveling.—THE TELEPHONE, THE OXY-HYDROGEN MICROSCOPE, and TORPEDOES, by Mr. King.—HAYLING ISLAND, WHERE IT IS AND ALL ABOUT IT, by Mr. J. L. King.—Admission to the whole, 1s.; Schools and Children under Ten, 6d. Reserved Stalls including Admission), 2s. 6d. Open at 12 and 7; Carriages at 5 and 10.

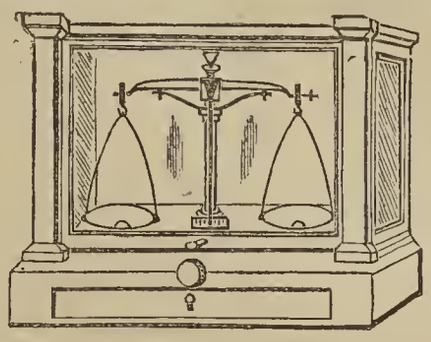
BECKER & SONS,

MANUFACTURERS OF

CHEMICAL AND GOLD ASSAY BALANCES

AND OTHER

SCALES AND WEIGHTS.

ROTTERDAM.  NEW YORK.

BECKER'S STUDENT'S BALANCE, in polished mahogany glass case, sliding front, counterpoised, to carry 30 grammes in each pan and turn to ½ milligramme, nickel plated pans..£2 10

Ditto, ditto, in mahogany glass case, polished black £2 13

Sole Agents for England, Ireland, and Wales:—

TOWNSON & MERCER,

Becker's Complete Lists forwarded by post on receipt of 1*d.* stamp, or free on application.

BISULPHIDE OF CARBON,

PROTOSULPHATE,

RED OXIDE

OXYCHLORIDE

Sulphocyanide,

And every other Mercurial Preparation.

BISULPHITE OF LIME, TETRACHLORIDE OF CARBON,

Oxysulphuret of Antimony, Glacial Acetic Acid,

LIQUOR AMMONIÆ,
SULPHIDE OF IRON,
PURE ACIDS,
CHLORIDE OF SULPHUR,
ACETONE,
CHLOROFORM,
ALDEHYDE,
CHLORATE BARYTA,
ARSENIC ACIDS,
FRUIT ESSENCES FOR CONFECTIONERY & LIQUEURS,
PERCHLORIDE OF IRON,
SULPHITE AND HYPOSULPHITE OF SODA,
PHOSPHATES OF SODA AND AMMONIA,
ETHERS,
BROMIDES,
IODIDES,
SCALE AND GRANULAR PREPARATIONS.

ALSO,

Pure Photographic Chemicals of every kind.

MANUFACTURED BY

WILLIAM BAILEY & SON,

HORSELEY FIELDS CHEMICAL WORKS,

WOLVERHAMPTON

ERECTION OF PLANT.

TO SULPHATE OF AMMONIA MANUFACTURERS AND OTHERS.

STILLS, SATURATORS, and all APPARATUS in connection with the above Erected upon the Most Approved Plan—result of 15 years practical experience.—Address, G. Tunbridge, Man. Chem. Dept., Gas Works, Leicester, or J. Barnes, Plumber, &c., Barking, Essex.

THE NEW MINIATURE SPRENGEL PUMP.

(STEARN AND SWAN'S PATENT.)

As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

CHEMISTS AND MANUFACTURERS

Are solicited, before purchasing Filter-Presses, to examine the merits of

JOHNSON'S PATENT HYDRAULIC FILTER,

And see whether, for—

CORRECTNESS OF PRINCIPLE,
DESIGN,
CONVENIENCE AND ECONOMY IN WORKING,
SOLIDITY AND EXCELLENCE OF WORKMANSHIP,
AND LOWNESS OF PRICE,

is not by far the Best, Cheapest, and Most Rapid means of Filtration in the Market, for—

SEPARATING SOLIDS FROM SEMI-FLUIDS,
FILTERING LIQUIDS BRIGHT,
WASHING PRECIPITATES,
DRYING PRECIPITATES, SLURRY OR SLUDGE.

in any quantities, large or small, with great economy in cloths, which never burst and are easily removed for cleaning when required. These are advantages which command its adoption over every other form of Filter.

Trials at the Works made Gratis in presence of Intending Purchasers.

Small Filter-Press for Laboratory Use, with Pump complete ... ... from £7.

JOHNSON'S ENGINEERING WORKS,
CARPENTER'S ROAD, STRATFORD.
London Offices - - - - - - - N. NUTTER, 71, Cornhill, E.C.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing rare Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for tudents, Schools, Colleges, &c.
NEW PATTERNS OF GEOLOGICAL HAMMERS.
NEW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
88, CHARLOTTE STREET, FITZROY SQUARE

Methylated Spirits.—David Smith Kidd
Licensed Maker, Commercial Street, Shoreditch, N.E
Also FINISH, FUSEL OIL and RECT. NAPHTHA

Ryall's Chemical Black Lead (Registered)
creates no waste or dust by its magnetic adherence to the stove and the cleanliness of application makes this one of the marvels o household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

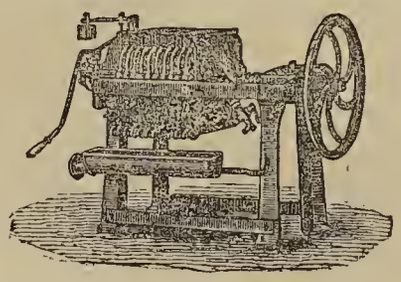
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

The speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction To Suit Special Requirements.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,
Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.

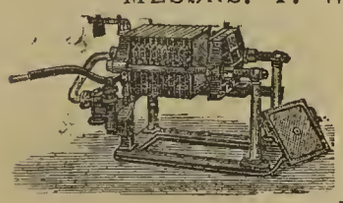
SULPHATE OF AMMONIA, ANTHRACENE.
BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

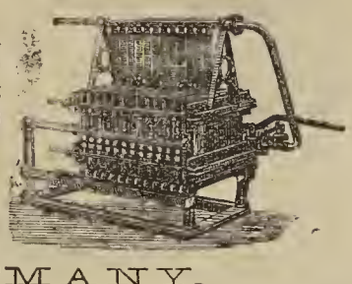
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud, slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes, White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also prote & purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.
And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Coal-Tar, Pitch, Creosote, Grease, Sulphate of Ammonia, Pyroligneous Acid, Acetate of Lime, Wood Naphtha, Charcoal, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

J. I. HEADLY, ENGINEER, Cambridge
Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of.

CHEMICAL & SCIENTIFIC APPARATUS

Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers
Mines, Universities, Schools, &c.,

89, Bishopsgate Street Within,
LONDON.

Also Agents for Prof. Wanklyn's Test Solutions for Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post free including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	a.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series o insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

PATENTS. PATENTS.

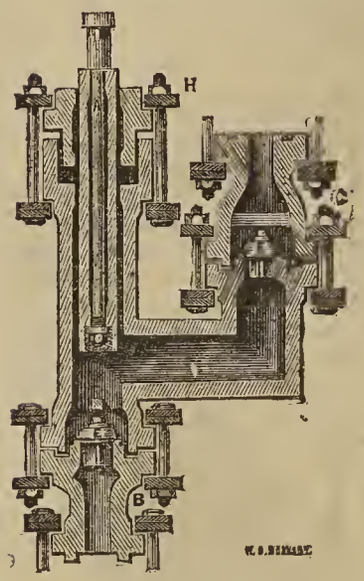
ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet, containing special advice, gratis or by post.—166, Fleet Street, London.

DOULTON & WATTS

HIGH STREET, LAMBETH, LONDON, S.E.

MANUFACTURERS OF

STONEWARE ACID PUMPS AND COCKS,



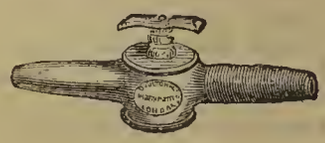
STILLS, RETORTS, CONDENSING WORMS

WOLFF'S BOTTLES

PERCOLATORS, AIR-TIGHT JARS,

And every description of Stoneware or Chemical Purposes, warranted to resist the strongest acids.

PLUMBAGO CRUCIBLES AND OTHER FIRE-STANDING GOODS.



CHEMISTS' & DRUGGISTS' GLASS. PORCELAIN TAPS

Price Lists of any of the above, and of every description of Stoneware, may be had on application.

Messrs. D. and W. were awarded a **MEDAL** for **ACID PUMPS**, and also one for **PLUMBAGO CRUCIBLES**, at the Vienna Exhibition, 1873.

Head Offices and Show Rooms, HIGH STREET, LAMBETH, S.E.

Depots :—Granville Wharf, Wood Street, Birmingham; 100, Soho Street, Liverpool ; Hope Street, Salford, Manchester ; and 6, Rue de Paradis Poissonière, Paris.

Just published, 2nd Edition, 594 pp., 8vo., price 12s. 6d.

ORGANIC MATERIA MEDICA.

By DR. MUTER.

Analytical Chemists will find this a concise and yet complete book of reference for the isolation and examination of the active principles of drugs. Special appendix on the microscopic characters of the starches in food and drugs. Copious index and qualitative courses or resins, &c.

Published by W. Baxter at the Office of the South London Schoo of Pharmacy, Kennington Cross, S.E., and sold by Messrs. Simpkin and Marshall and Messrs. Baillière, Tindal, and Cox.

JAMES WOOLLEY, SONS, & CO.

69, MARKET STREET, MANCHESTER,

DEALERS IN

CHEMICAL AND SCIENTIFIC APPARATUS CHEMICAL REAGENTS, &c.,

FOR THE USE OF

ANALYSTS, SCIENCE TEACHERS, AND MANUFACTURERS

Price Lists on application

FACTORIES
Reddish and Bradfoid,
MANCHESTER.

CHARLES LOWE & CO.,

(Established 1860.)

TOWN OFFICES :
61, Piccadilly,
MANCHESTER.

MANUFACTURERS OF

Pure Carbolic Acid, Cryst. at 42°·2 C.	Discovered by C. Lowe.		Carbolic Acid Glycerine Solutions.	Benzol (Cryst.).
,, ,, do. Hydrate of			Cresylic Acid.	Anthracene.
Medicinal do. Cryst. at 35° C.			Sulpho-Phenic Acid (Cryst.	Naphthaline.
Commercial do. No. 1 ,, 35° C.			Sulpho-Phenates & Sulpho-Cresylates of Soda, Potash, Zinc, Iron, and Alumina.	Picric Acid (Crystal and Paste).
,, do. 2 ,, 29° C.				Aurine (Rosolic Acid) Cake and Solution.
,, do. 3 ,, 12° C.				
,, do. 4 liquid at 10° C.				
Carbolic Acid Disinfecting Powder.				

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

JOHN CLIFF,
STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY
RUNCORN.

London Printed and Published for the Proprietor by Edwin John Davey, at the Office, Boy Court, Ludgate Hill, E.C.
June 14, 1878.

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

[Edited by Wm. Crookes, F.R.S.] (WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE") [Established Twenty-six Years.

Vol. 37.—No. 969.] Copyright reserved. Friday, June 21, 1878. Registered as a Newspaper. [PRICE, 4d. POST FREE, 4½d

CONTENTS.

ARTICLES:— PAGE
The Relaying of the Telephone, by Profs. Edwin J. Houston and Elihu Thomson 255
On Relations among the Atomic Weights of the Elements, by John A. R. Newlands, F.I.C., F.C.S 255
On the Estimation of Tannins, by H. R. Procter 256
On Dyer's Chemicals, by J. Marzell 258
Composition and Quality of the Metropolitan Water 261
NOTICES OF BOOKS.—Ure's Dictionary of Arts, Manufactures, and Mines—Ninth Annual Report of the State Board of Health of Massachusetts—Report on the Progress of the Iron and Steel Industries in Foreign Countries—Bulletin of the Bussey Institution 259
CHEMICAL NOTICES FROM FOREIGN SOURCES 262
MISCELLANEOUS.—Russian Scientific News—Tokio University, Japan—American Association for the Advancement of Science 265
NOTES AND QUERIES.—Formic and Acetic Acids—Distillation of Shales 265
MEETINGS FOR THE WEEK 262

SULPHATE OF LEAD,

EAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

PROFESSOR HUGHES'S MICROPHONE.

This wonderful instrument may be had, with batttery, switch, and receiver complete, for One Guinea of—

HORATIO YEATES,

Optician and Philosophical Instrument Maker,

33, KING ST., COVENT GARDEN.

WILLIAM AND WILLIAM T. FIELD,

MANUFACTURERS of the Celebrated STAFFORDSHIRE BLUE BRICKS, specially adapted for Chemical Plant, *i.e.*, Acid Towers, &c. Also all other kinds of Best Staffordshire Blue Bricks, Pavings, Plynths, Splays, Copings, &c., &c. Prices and samples on Application.

TESTIMONIAL.

"We have used the Blue Staffordshire Brick or Sulphuric Acid Towers, &c., manufactured by Messrs. Field, for the last fifteen years, during which time they have given great satisfaction. We recommend them to the Chemical Trade, believing there is nothing better in the market."—(Signed) WILLIAM HUNT and SONS, Lea Brook Alkali Works, near Wednesbury, Staffordshire, February, 1878.

TOLL END BRICK-WORKS,

TIPTON, STAFFORDSHIRE.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 186, Sauchiehall, Street, Glasgow.

GRIFFIN'S

CHEMICAL HANDICRAFT.

SECOND EDITION.

Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:

ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.

Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.

Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

A Chemist (24), Associate of Government College, Author of several Original Researches and Methods of Analysis, experienced as Analyst, seeks an Engagement. Is Author of Practical Book on Chemistry, and has reading knowledge of French and German. Good testimonials. Moderate progressive salary.—Address, T. B., Stafford House, Hampton Road, Birchfields Birmingham.

To be Sold, by Private Contract, an excellent and old-established Chemical Manufacturing and Drysalting Business, together with extensive works at Manchester, Glasgow, and Ayr. The business is a very lucrative one, and is in full working order. The sole reason for selling is the death of the last surviving partner. Only principals or their solicitors will be treated with.—Apply to Slater, Heelis, and Co., Solicitors, 75, Princes Street, Manchester.

MR. COX, VALUER OF CHEMICAL PLANT, offers his services on the usual terms. Twenty years' experience. Estimates for all description of plant, plans, &c.—Glenmohr House, New Charlton, London, S.

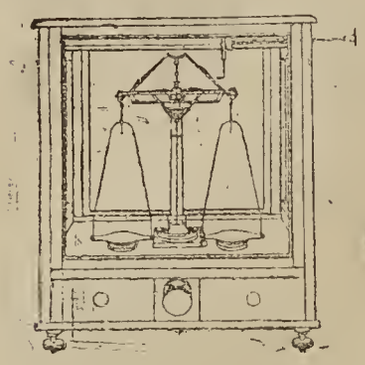
Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester

ROYAL POLYTECHNIC.—THE PARIS EXHIBITION, illustrated by Dissolving Views, the Information and Photographs supplied by the French and British Commissions, by Mr. J. L. King.—THE KAFFIR WAR, by Mr. W. R. May.—MODERN GUNS AND PROJECTILES, THE MICROPHONE AND TELEPHONE, &c., by Mr. J. L. King.—CLAY AND THE POTTER, by Prof. Gardner.—Concluding daily at 4 and 9 with THE SIEGE OF TROY, with Grand, Optical, Spectacular, and Pyrotechnic Effects, by Mr. Lin Rayne.—Admission to the whole, 1s.; Schools and Children under Ten, 6d. Open at 12 and 7; Carriages at 5 and 10.

NOTICE TO THE TRADE.

To prevent delay and to suit the convenience of the Wholesale Newsagents the CHEMICAL NEWS *will in future be printed on Thursda night, and delivered to the trade at 9 o'clock o Friday morning.*

Boy Court, Ludgate Hill
May 1, 1878.



L. OERTLING,

TURNMILL STREET

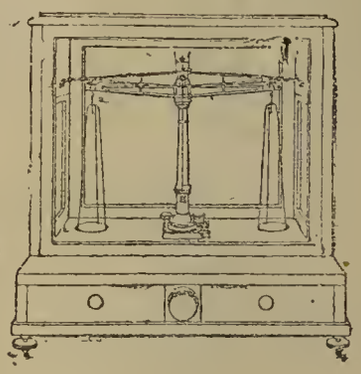
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

ESTABLISHED 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal-Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's Patent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

MILTON CHEMICAL WORKS, STOKE-ON-TRENT, STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street, E.C., who hold stock ready for delivery.

THOMAS ADKINS & CO.,

SMETHWICK,

NEAR BIRMINGHAM

MANUFACTURERS OF SPECIALLY PREPARED RED LEAD FOR FLINT-GLASS MAKING.

BISULPHIDE OF CARBON,

CHLORIDE OF SULPHUR.

GAS PURIFICATION & CHEMICAL CO., LIMITED,

161, 162, 163, PALMERSTON BUILDINGS, LONDON, E.C.

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS

LIQUOR AMMONIA, &c.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,

LABORATORY FURNISHERS,

7, Exchange Street and 10, Half Moon Street,

MANCHESTER

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy. "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V. GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

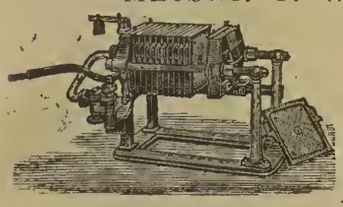
POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE.
BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

IMPROVED FILTER-PRESSES.

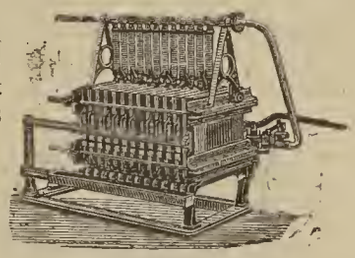
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON



Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.



WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.
And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Coal-Tar, Pitch, Creosote, Grease, Sulphate of Ammonia, Pyroligneous Acid, Acetate of Lime, Wood Naphtha, Charcoal, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

J. I. HEADLY, ENGINEER, Cambridge,
Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

TOWNSON & MERCER

(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Also Agents for Prof. Wanklyn's Test Solutions for Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

THE CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post free including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series of insertions.

Cheques and Post-Office Orders, crossed "London and County Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street, London.

TAR DISTILLERS
DRYSALTERS
BOUCK & Co
LIMITED
MILES PLATTING,
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL White Lead, Sulp. Zinc, Nitric Acids &c. &c.
BRIMSTONE REFINERS
Samples & prices on application.
J. J. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE Oxalic Acid, Picric Acid, Sal-Aceto... BICHROME CHLORATE OF POTASH, &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

CALVERT'S CARBOLIC ACID.

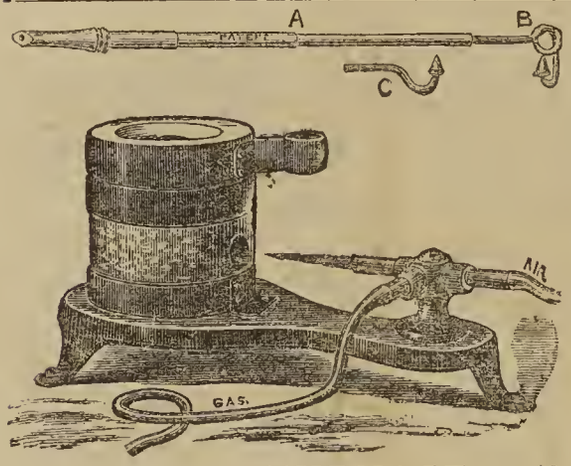
HIGHEST PRIZE MEDAL AT PARIS EXHIBITION, 1867.

GOLD AND SILVER MEDALS, HAVRE, 1868. DIPLOME D'EXCELLENCE, AMSTERDAM.

SILVER MEDAL, FIRST CLASS, NAPLES, 1871. GOLD MEDAL, MOSCOW, 1872.

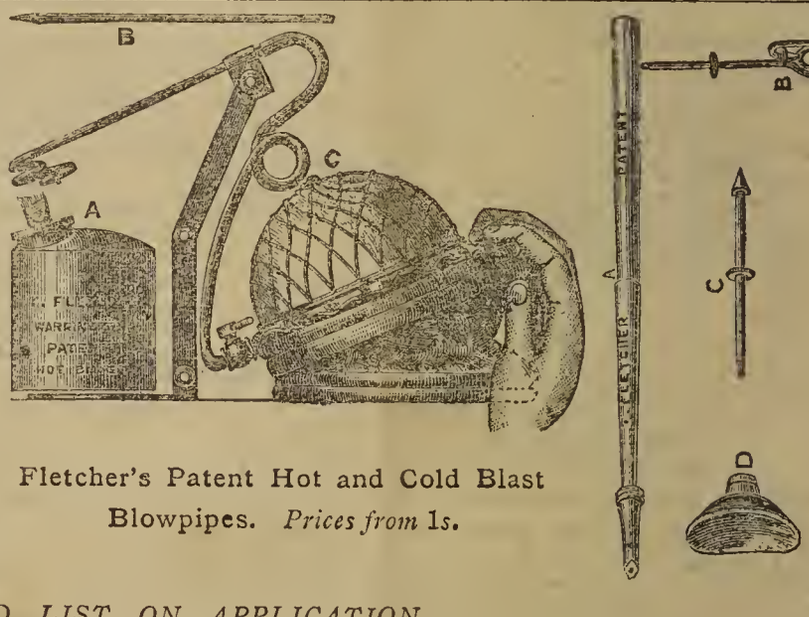
F. C. CALVERT & CO., of Bradford, Manchester (original and only Manufacturers of pure Medical Carbolic Acid), beg to inform the Trade and large Consumers that their pure Medical Carbolic as well as cheaper qualities for Commercial, Veterinary, and Disinfecting Purposes, also Carbolic Acid Soaps for Medical, Toilet, and General Use, Soft Soap for Dogs, and Carbolic Acid Disinfecting Powder, may be had from any of the below-named Wholesale Agents—

Apothecaries' Soc., Lond'n
Apothecaries' Co, Glasg'w
Apothecaries' Hall, Dublin
Allen & Hanburys
J. Bell & Co.
Barron, Harveys, & Co.
Barclay & Sons.
Burgoyne & Co.
Baiss Brothers & Co.
Barron, Squire, & Co.
Battley & Watts
Bewley & Draper
H. B. Brady
ainbridge & Pound
Boileau & Boyd
Curling & Co.
Corbyn & Co.
Clarke, Bleasdale, & Co.
Clay, Dod, & Case
Dakin Brothers
Davy, Yates, & Co.
Duncan, Flockhart, & Co.
W. Bowaros & Son
Evans, Lescher, & Evans
Evans, Sons, & Co.
Evans, Gadd, & Co.
Ferris & Co.
Glasgow New Apoth. Co.
General Apothecaries' Co.
W. & H. M. Goulding
Goodall, Backhouse, & Co.
Grimwade, Ridley, & Co.
Hodgkinsons, Stead, & Co.
Herrings & Co.
Hodgkinsons, Preston, & King
Hearon, Squire, & Francis
Hopkin & Williams
Howards & Sons
Hirst, Brooke, & Co.
W. R. Hatrick & Co.
P. Harris & Co.
Hunt & Co.
J. Ismay
Johnson & Sons
Langtons, Edden, & Hicks
Lynch & Co.
Lofthouse & Saltmer
Chas. Leslie
Maw, Son, & Thompson
H. C. Mason
W. Mather
McMaster, Hodgson, & Co.
J. F. Macfarlan & Co.
J. Mackay
R. H. Millard & Son.
Mackey, Sellers, & Co.
Mottershead & Co.
Newbery & Sons
Paterson & Son
Raimes & Co.
J. Richardson & Co.
Raimes, Blanshards, & Co.
J. Reddish & Co.
Sanger & Sons
Savory & Moore.
W. Sutton & Co.
R. Sumner & Co.
James Sim & Co,
Sang & Barker
Southall, Bros., & Co.
W. Smeeton
Slinger & Barnett
P. Sandeman & Co.
Tidman & Son
Taylor, Gibson, & Co.
Thacker & Hoffe
Jas. Taylor
J. Woolley, Sons, & Co
Wyleys & Co.
Wilson & Kitchen
C. H. Warner & Co.
A. & J. Warren
Walkington & Son
Wright, Layman, & Umney



A SIMPLE FURNACE. 7/6.

Will melt 8 ozs. Gold, Cast-Iron, &c., in a few minutes. Can be used for cupelling or roasting, and the burner for glass-blowing, brazing, &c.



Fletcher's Patent Hot and Cold Blast Blowpipes. *Prices from* 1s.

ILLUSTRATED LIST ON APPLICATION.

THOS. FLETCHER, MUSEUM STREET, WARRINGTON.

FACTORIES
Reddish and Bradford,
MANCHESTER.

CHARLES LOWE & CO.,

(Established 1860.)

TOWN OFFICES:
61, Piccadilly,
MANCHESTER.

MANUFACTURERS OF

Pure Carbolic Acid, Cryst. at 42°·2 C. } Discovered by C. Lowe.
,, ,, do. Hydrate of }
Medicinal do. Cryst. at 35° C.
Commercial do. No. 1 ,, 35° C.
,, do. 2 ,, 29° C.
,, do. 3 ,, 12° C.
,, do. 4 liquid at 0° C.
Carbolic Acid Disinfecting Powder.

Carbolic Acid Glycerine Solutions.
Cresylic Acid.
Sulpho-Phenic Acid (Cryst.
Sulpho-Phenates & Sulpho-Cresylates of Soda, Potash, Zinc, Iron, and Alumina.

Benzol (Cryst.).
Anthracene.
Naphthaline.
Picric Acid (Crystal and Paste).
Aurine (Rosolic Acid) Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

JOHN CLIFF,
STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
No. IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY
RUNCORN.

London: Printed and Published for the Proprietor by Edwin John Davey, at the Office, Boy Court, Ludgate Hill, E.C
June 21, 1878.

SOCIETY OF GREAT BRITAIN

THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

Edited by Wm. Crookes, F.R.S.

(WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE")

Established Twenty-six Years

Vol. 37.—No. 970. *Copyright reserved.* Friday, June 28, 1878. *Registered as a Newspaper.* PRICE, 4d. POST FREE, 4½d

CONTENTS.

ARTICLES:— PAGE
On Areometers, by P. Casamajor 267
Note on the Ferment-Theory of Nitrification, by F. H. Storer.. 268
PROCEEDINGS OF SOCIETIES:—
CHEMICAL SOCIETY.—Contributions to the History of the Naphthalene Series—On Pyrotritaric and Carbo-pyrotritaric Acids—Action of Alkaline Hypobromite on Ammonium Salts, Urea, and Oxamide—Action of the Halogens at High Temperatures on Metallic Oxides—On Manganese Tetrachloride—On Salts of Nitrous Oxide—Notes on Madder Colouring Matters—Occlusion of Hydrogen by Copper—Rôle Played by Carbon in Reducing the Sulphates of the Alkalies—Action of Ethyl-chlor-carbonate on some Oxygenated Haloid Compounds of the Fatty Series—Laboratory Notes 270
PHYSICAL SOCIETY.—A New Form of Polariscope—Effect of Starch, Salicene, Unannealed Glass, &c., on Polarised Light—Flow of Water from Orifices at Different Temperatures—Complementary Colours—Magnetic Figures Illustrating Electrodynamic Relations—Co-ordination of Space 271
CORRESPONDENCE.—Sugar Tests 273
CHEMICAL NOTICES FROM FOREIGN SOURCES..... 273
MISCELLANEOUS.—Sewage Farming at Gennevilliers, Paris—Manchester and Salford Sanitary Association 276
NOTES AND QUERIES.—Formic and Acetic Acids..... 276

SULPHATE OF LEAD,

EAD ASHES, AND OTHER METAL RESIDUE

Purchased. Address samples

CAPPER PASS & SON,

BEDMINSTER SMELTING WORKS, BRISTOL.

PROFESSOR HUGHES'S MICROPHONE.

This wonderful instrument may be had, with batttery, switch, and receiver complete, for One Guinea of—

HORATIO YEATES,

Optician and Philosophical Instrument Maker,

33, KING ST., COVENT GARDEN.

MACTEAR'S PATENT CARBONATING FURNACE,

AND

JONES AND WALSH'S PATENT SULPHATE OF SODA FURNACE,

MANUFACTURED BY

R. DAGLISH & CO.,

ST. HELEN'S ENGINE ANL BOILER WORKS,

LANCASHIRE.

Prices and other particulars on application.

SPECIAL NOTICE.

GEORGE MASON and CO.'S NEW CATALOGUE is Now Ready to be sent out. No Chemist or Student should be without a copy of it, as it is certainly one of the most complete lists in the trade, and an invaluable guide for Professional and Manufacturing Chemists when buying. This New Edition is much larger than any previous one, and contains nearly one hundred extra Wood Engravings, with all the Latest Quotations and Descriptions of Chemical Apparatus and Appliances, Pure Chemicals, and Reagents. Sent post free on receipt of 14 stamps. Also New Book of Chemical Labels with New Notation. Free on receipt of 7 stamps.—GEORGE MASON and CO. (Successors to John Spencer), 186, Sauchiehall, Street, Glasgow.

GRIFFIN'S

CHEMICAL HANDICRAFT.

SECOND EDITION.

Price 4s. 7d. post free.

A CATALOGUE OF CHEMICAL APPARATUS:

ILLUSTRATED, CLASSIFIED, DESCRIPTIVE.

Demy 8vo., 480 pp., Illustrated with 1600 Woodcuts.

Most complete and cheapest List of Apparatus.

JOHN J. GRIFFIN and SONS, 22, Garrick Street, London, W.C.

Just published (London: J. and A. CHURCHILL). price 16s.

A HANDBOOK OF MODERN CHEMISTRY. By CHARLES MEYMOTT TIDY, M.B., F.C.S., Professor of Chemistry and of Forensic Medicine at the London Hospital.

Advertiser desires a Situation as Assistant Chemist in a College or Works. Has studied at the Royal College of Chemistry, and has had considerable experience in general analysis, &c. Good references.—Apply, X., Tomlinson and Co., 68, Mile End Road.

A Young Man (23), with seven years' experience in analysis and experimental chemistry, desires a Re-engagement as Assistant Chemist.—Andress, R. R., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

A Young Chemist (20) who has studied analysis for two years in one of the best laboratories in the kingdom, and has made the different processes of an alkali works a special study, desires an Engagement as Chemist or Manager's Assistant. Can be highly recommended.—Address, Alkali, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

Wanted, a Man thoroughly acquainted with the manufacture of Creta Præcip., for Chalk Works in the country.—Apply by letter, stating wages expected, to G. B., CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

TO GAS COMPANIES AND MANUFACTURING CHEMISTS.

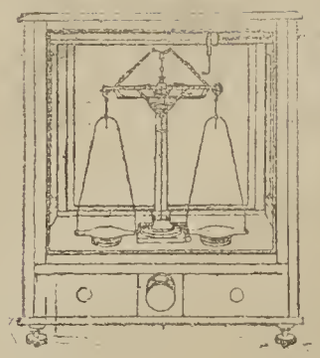
The Advertiser wishes an Engagement as Manager for the Manufacture of Sulphate of Ammonia in all its branches of manufacture, and thoroughly understands the erection of Works in all its branches, and willing to erect Works and show the principles on agreement.—S. C., 63, St. Leonard's Street, Bromley-by-Bow, London.

MR. COX, VALUER OF CHEMICAL PLANT, offers his services on the usual terms. Twenty years' experience. Estimates for all description of plant, plans, &c.—Glenmohr House, New Charlton, London, S.

NOTICE TO THE TRADE.

To prevent delay and to suit the convenience of the Wholesale Newsagents the CHEMICAL NEWS *will in future be printed on Thursday night, and delivered to the trade at 9 o'clock on Friday morning.*

Boy Court, Ludgate Hill
May 1, 1878.



L. OERTLING,

TURNMILL STREET

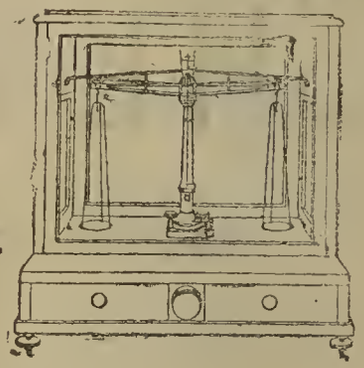
(OPPOSITE FARRINGDON STREET) STATION.

MANUFACTURER OF

CHEMICAL, ASSAY, & BULLION BALANCES.

Maker to the Bank of England, Assay Office of the Royal Mint, &c., &c.

By Appointment.



COUNCIL MEDAL, 1851. FIRST CLASS MEDAL, 1854 and 1862.

Established 1798.

ROBERT DAGLISH & CO.,

ENGINEERS, BOILER AND BRIDGE MAKERS, MILLWRIGHTS,

BRASS AND IRON FOUNDERS.

Manufacturers of every description of Condensing, or High Pressure Blowing, Pumping, Rolling, Winding, and Patent Steam Engines of any required power, for Irrigating, Draining, Mining, Rolling Mills, or Water Works purposes, and Manufacturers of every description of Chemical, Colliery, Copper Ore, Gold Mining, Glass, and Rock Sal- Machinery.

Black Ash Revolving Furnaces of the Most Approved Type.

Bessemer Steel Rail Plant.

Compressing Engines for Collieries, Iron Works, and Weldon's atent Bleaching-Powder Process.

Caustic, Chlorate, Decomposing, Nitro-Glycerine, Iodine, Sulphur Acid, and Oxalic Pans.

Gas Producers Patent for Heating and other Purposes.

Pyrites Burners for Irish, Norwegian, and Spanish Ores of Improved Construction.

Patent Rousing Machinery for Brewers.

Retorts, Acid, Gas, Iodine, Nitric, Nitre, Nitro-Glycerine, and Vitriol Refining.

Steam Superheaters improved for Oil, Tar, and Resin Refining.

Steam Sulphur Melter.

Stills for Oil, Resin, and Tar.

Wheels, Bevel, Mitre, and Spur Moulded on the Shortest Notice by Patent Machinery.

Lists sent on Application.

Photographs, Plans, and other information supplied on receipt of Order.

ST. HELEN'S ENGINE WORKS AND FOUNDRY LANCASHIRE.

MILTON CHEMICAL WORKS, STOKE-ON-TRENT, STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

---

BISULPHITE OF LIME.
BISULPHITE OF SODA.

WILLIAM MARRIOTT
CHEMICAL WORKS HUDDERSFIELD

Silicates of Soda and Potash in the state of Soluble glass, or in CONCENTRATED SOLUTION of first quality, suited for the manufacture of Soap and other purposes supplied on best terms by W. GOSSAGE and Sons, Soap Works Widnes, Lancashire.

London Agents, COSTE and Co., 19 and 20, Water Lane, Tower Street, E.C., who hold stock ready for delivery.

THOMAS ADKINS & CO.,

SMETHWICK,

NEAR BIRMINGHAM

Manufacturers of Specially Prepared Red Lead for Flint-Glass Making.

BISULPHIDE OF CARBON,

CHLORIDE OF SULPHUR.

GAS PURIFICATION & CHEMICAL CO., LIMITED,
161, 162, 163, Palmerston Buildings, London, E.C.

EARP & CHASTER,

RUNCORN,

MAKERS OF

CHEMICALLY PURE MINERAL ACIDS
LIQUOR AMMONIA, &c.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy. "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

---

A. BOAKE & CO.,

STRATFORD, LONDON, E.,

MAKERS OF

THE SULPHITES AND BISULPHITES

OF

SODA AND LIME.

THE
QUARTERLY JOURNAL OF SCIENCE.

Edited by WILLIAM CROOKES, F.R.S., &c

Now ready, No. LIX., *July*, 1878, price 5s.

CONTENTS.

I. The Senses of the Lower Animals.
II. The Superficial Gravels and Clays around Finchley, Ealing, and Brentford. By Thomas Belt, F.G.S.
III. On the Possibility of Explaining Past Changes in the Universe by Causes at Present in Operation. By S. Tolver Preston.
IV. The Evolution of Beauty. By T. F. Mott, F.R.G.S.
V. Feeling and Energy; Alternate Affections of Matter. By W. S. Duncan.

Notices of Scientific Works, Scientific Notes, &c.

London: 3, Horse-Shoe Court, Ludgate Hill, E.C.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 22, Albemarle Street, W.—The NEXT ANNUAL GENERAL MEETING will be held at DUBLIN, commencing on WEDNESDAY, August 14.

President-Elect.

W. SPOTTISWOODE, Esq., LL.D., F.R.S., F.R.A.S., F.R.G.S.

NOTICE to CONTRIBUTORS of MEMOIRS.—Authors are reminded that, under an arrangement dating from 1871, the acceptance of Memoirs, and the days on which they are to be read, are now, as far as possible, determined by Organising Committees for the several Sections before the beginning of the Meeting. It has therefore become necessary, in order to give an opportunity to the Committee of doing justice to the several Communications, that each Author should prepare an Abstract of his Memoir, of a length suitable for insertion in the published Transactions of the Association, and that he should send it, together with the original Memoir, by book-post, on or before August 1, addressed thus:—"General Secretaries, British Association, 22, Albemarle Street, London, W. For Section ....." If it should be inconvenient to the Author that his Paper should be read on any particular day, he is requested to send information thereof to the Secretaries in a separate note.

G. GRIFFITH, M.A.,
Assistant-General Secretary, Harrow.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V. GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

TELEPHONY AND MICROPHONY.

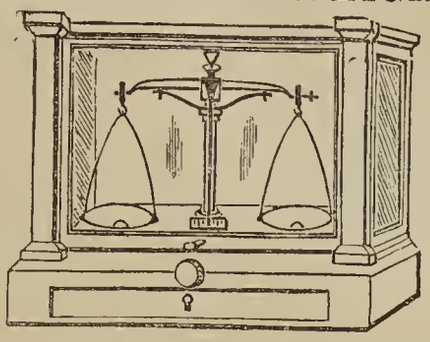
PROFESSOR HUGHES'S MICROPHONE, of the most Sensitive Construction, 4s. 6d., post free; with 3-Cell Daniell's Battery, 13s., carriage paid. Telephone Call-Bells, with Key, Switch, and Battery, £3 the Two Sets.—All Materials and Apparatus for Telegraphic and Experimental Electricity, of Edward Paterson, Manufacturing Electrician, 3, Bedford Court, Bedford Street, Strand.

ROYAL POLYTECHNIC.

The Directors, having determined upon reconstructing the Scientific and Chemical Department of the Institution, invite applications from Graduates of Universities and other Chemical and Scientific men, with a view to leasing the Laboratory and Class-rooms, with Use of Science Theatre.—Applications to be made, in writing, to the Secretary Superintendent, 309, Regent Street, W.

To be Sold, by Private Contract, an excellent and old-established Chemical Manufacturing and Drysalting Business, together with extensive works at Manchester, Glasgow, and Ayr. The business is a very lucrative one, and is in full working order. The sole reason for selling is the death of the last surviving partner. Only principals or their solicitors will be treated with.—Apply to Slater, Heelis, and Co., Solicitors, 75, Princes Street, Manchester.

BECKER & SONS,
MANUFACTURERS OF
CHEMICAL AND GOLD ASSAY BALANCES
AND OTHER
SCALES AND WEIGHTS.

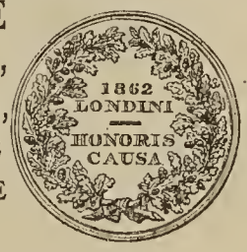


BECKER'S STUDENT'S BALANCE, in polished mahogany glass case, sliding front, counterpoised, to carry 30 grammes in each pan and turn to ½ milligramme, nickel plated pans..£2 10
Ditto, ditto, in mahogany glass case, polished black £2 13

Sole Agents for England, Ireland, and Wales:—
TOWNSON & MERCER,

Becker's Complete Lists forwarded by post on receipt of 1*d.* stamp, or free on application.

BISULPHIDE OF CARBON,
PROTOSULPHATE,
RED OXIDE
OXYCHLORIDE
Sulphocyanide,



And every other Mercurial Preparation.

BISULPHITE OF LIME, TETRACHLORIDE OF CARBON
Oxysulphuret of Antimony, Glacial Acetic Acid,

LIQUOR AMMONIÆ,
SULPHIDE OF IRON,
PURE ACIDS,
CHLORIDE OF SULPHUR,
ACETONE,
CHLOROFORM,
ALDEHYDE,
CHLORATE BARYTA,
ARSENIC ACIDS,
FRUIT ESSENCES FOR CONFECTIONERY & LIQUEURS,
PERCHLORIDE OF IRON,
SULPHITE AND HYPOSULPHITE OF SODA,
PHOSPHATES OF SODA AND AMMONIA,
ETHERS,
BROMIDES,
IODIDES,
SCALE AND GRANULAR PREPARATIONS.

ALSO,
Pure Photographic Chemicals of every kind.
MANUFACTURED BY
WILLIAM BAILEY & SON,
HORSELEY FIELDS CHEMICAL WORKS,
WOLVERHAMPTON

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester

ROYAL POLYTECHNIC.—THE PARIS EXHIBITION, illustrated by Dissolving Views, the Information and Photographs supplied by the French and British Commissions, by Mr. J. L. King.—THE KAFFIR WAR, by Mr. W. R. May.—MODERN GUNS AND PROJECTILES, THE MICROPHONE AND TELEPHONE, &c., by Mr. J. L. King.—CLAY AND THE POTTER, by Prof. Gardner.—Concluding daily at 4 and 9 with THE SIEGE OF TROY, with Grand, Optical, Spectacular, and Pyrotechnic Effects, by Mr. Lin Rayne.—Admission to the whole, 1s.; Schools and Children under Ten, 6d. Open at 12 and 7; Carriages at 5 and 10.

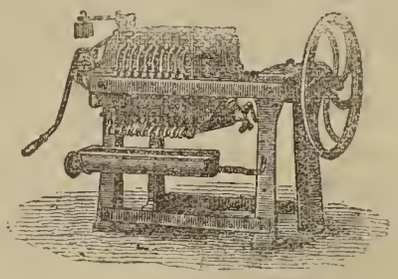
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

THE speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing rare Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for tudents, Schools, Colleges, &c.

NEW PATTERNS OF GEOLOGICAL HAMMERS.

NEW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
38, CHARLOTTE STREET, FITZROY SQUARE

THE NEW MINIATURE SPRENGEL PUMP.
(STEARN AND SWAN'S PATENT.)

As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove and the cleanliness of application makes this one of the marvels o household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

PROF. HUGHES'S MICROPHONE,

Price 10/6, 15/, 21/.

The 10s. 6d. is a neat instrument in polished mahogany case for the table or pocket.

The 15s. is a more sensitive instrument. It will magnify delicate sounds, and render audible sounds, such as the tramp of a fly in walking.

The 21s. instrument include a 3-cell battery and 10 yards of conducting wire.

M. JACKSON & CO.,
65, BARBICAN, LONDON, E.C.

SCIENTIFIC APPARATUS MANUFACTURERS.

Price Lists 3d. and 1s. each.

SPECIALITIES.

MANGANESE — Lump, Crystallised, Ground, and Prepared Large stock of every description. *** *Suitable for all Trades.*

ARSENIC — Refined powdered, Lump, Grey, and Ruby.

FLUOR-SPAR — Finest produced. Medium and Common for all purposes.

BARYTES — Carbonate and Sulphate. All qualities of Lump and Ground.

BAUXITE — Of high percentage of Alumina and low in Iron.

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,

5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

MANCHESTER CORPORATION GAS-WORKS.

AMMONIACAL LIQUOR.

The Gas Committee of the Corporation of Manchester are prepared to RECEIVE TENDERS for the PURCHASE of the AMMONIACAL LIQUOR to be produced at their Gaythorn and Rochdale Road Works during a period of one or more years, commencing from the 1st day of January, 1880. In addition to tenders for the purchase of the liquor in its crude state, the Committee will also be prepared to consider tenders for its disposal, either by manufacture into sulphate of ammonia at the above-mentioned works on their behalf, or in any other manner. The Committee reserve to themselves the option of accepting the offer the terms of which they deem most advantageous. They do not bind themselves to accept the highest or any tender. Sealed tenders, addressed to the Chairman of the Gas Committee, Town Hall, and endorsed "Tender for Ammoniacal Liquor," must be delivered at these offices on or before Thursday, the 1st day of August next.—Forms of tender and further particulars can be obtained on application to Mr. George B. Jackson, at the Gas Offices.—By order of the Gas Committee,

JOSEPH HERON, Town Clerk.

Town Hall, Manchester, 31st May, 1878.

F. W. BERK & CO.,

1, LIME STREET AVENUE, LONDON, E.C.

IMPORTERS AND EXPORTERS OF

POTASH—Muriates and Sulphates of various strength.
PEARL-ASH—German and French.
SALTPETRE—German, granulated.
KIESERIT—(Sulphate of Magnesia).
KAINIT and all other Potash Manure Salts.
SALTS OF TARTAR.
SODA CAUSTIC—Crystals and Ash.
SULPHATE OF AMMONIA, ANTHRACENE.
BENZOLE, and other Tar Products.
BLEACHING-POWDER.
BICHROMATE OF POTASH.
CHLORATE OF POTASH.
OXALIC ACID.
And other Chemicals.

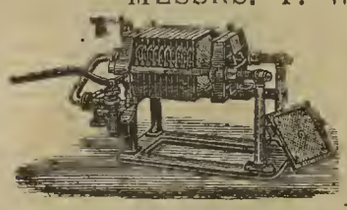
IMPROVED FILTER-PRESSES.

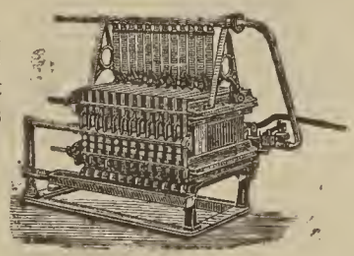
Made of Wood, Iron, Bronze, or Lead. Suitable for the quick and sure separation of solid substances, as mud slime, or chemical precipitates from fluids of all kinds. Very useful for the production of Alizarine, Aniline, Barytes White Lead, Chrome Colours, Oxide of Iron, Gelatine, Glucose, Glycerine, Black-lead, Yeast, Ochre, Paraffin, Ceresine, Pyroligneous Acid, Caustic Soda, Sulphate of Quinine, Patent White, Satin White, Phosphate of Lime, China Clay, Starch, Stearine, Ultramarine, Umbra, Zinc White, &c., &c. We would call special attention to our improved Filter-Presses, as they have many advantages over similar apparatus as to construction, durability, and easy management. THEY IN NO WAY INFRINGE ON ANY ENGLISH PATENT.

Our sole Agents for the United Kingdom—

MESSRS. F. W. BERK & CO., 1, LIME STREET AVENUE, LONDON

Will give on application full particulars, and will also protect purchasers against any alleged infringements of patents held by other makers of Filter-Presses.





WEGELIN & HÜBNER,
Engineers,
HALLE-ON-SAALE GERMANY

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.

And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol, Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Coal-Tar, Pitch, Creosote, Grease, Sulphate of Ammonia, Pyroligneous Acid, Acetate of Lime, Wood Naphtha, Charcoal, &c., &c.

S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.

All communications to be addressed to the offices at Middlesbrough.

J. I. HEADLY, ENGINEER, Cambridge
Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

TOWNSON & MERCER
(LATE JACKSON & TOWNSON),
Wholesale and Export Dealers and Manufacturers of
CHEMICAL & SCIENTIFIC APPARATUS
Graduated Instruments, Pure Chemicals, &c.,
Analysis and the general Laboratory Use of Manufacturers Mines, Universities, Schools, &c.,
89, Bishopsgate Street Within,
LONDON.
Also Agents for Prof. Wanklyn's Test Solutions for Water Analysis

Illustrated Catalogue post free on receipt of 3 stamps.

TETRACHLORIDE OF CARBON.
BISULPHIDE OF CARBON.
CHLORIDE OF SULPHUR.

JESSE FISHER & SON,
Phœnix Chemical Works Ironbridge.

THE CHEMICAL NEWS
AND
JOURNAL OF PHYSICAL SCIENCE.

Edited by WILLIAM CROOKES, F.R.S.,

Published every Friday. Price 4d. Annual Subscription, post free including Indices, £1

CHARGES FOR ADVERTISEMENTS.

	£	s.	d.
Five lines in column (about 10 words to line)	0	3	6
Each additional line	0	0	6
Whole column	1	15	0
Whole page	3	0	0

A reduction made for a series of insertions.

Cheques and Post-Office Orders, crossed "London and Count Bank," payable to the order of William Crookes.

BOY COURT, LUDGATE HILL LONDON, E.C

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street, London.

TAR DISTILLERS
DRYSALTERS
BOUCK & Co LIMITED
MILES PLATTING
MANCHESTER
MANUFACTURERS OF ANTHRACENE, BENZOLE, CARBOLIC ACIDS, NAPHTHA, Sulphate of Ammonia PITCH & CREOSOTE SULPHATE OF COPPER VITRIOL Nitrate Lead, Sulp Zinc. Nitric Acids &c &c
BRIMSTONE REFINERS
Samples & prices on application.
J.I. VAUGHAN Secretary
AGENTS FOR Best Scotch & English RED & YELLOW PRUSSIATE OXALIC ACID. PICRIC ACID. Sal-Acetosella BICHROME CHLORATE OF POTASH, &c. &c.
BUYERS OF COAL TAR AND AMMONIACAL LIQUOR

DOULTON & WATTS

HIGH STREET, LAMBETH, LONDON, S.E.

DEPOTS:—GRANVILLE WHARF, WOOD STREET, BIRMINGHAM; 100, SOHO STREET LIVERPOOL; AND 18, RUE MARTEL, PARIS.

MANUFACTURERS OF

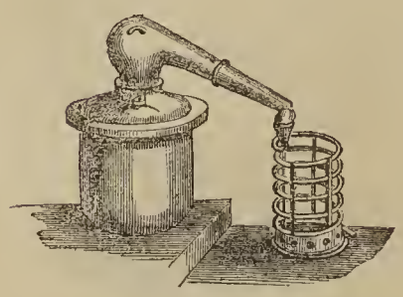
STILLS, RETORTS, CONDENSING WORMS, WOLLF'S BOTTLES

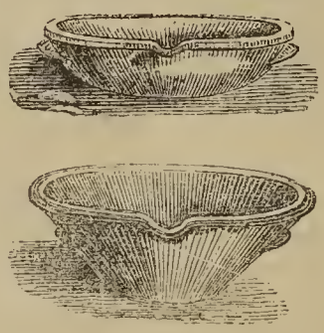
ACID PUMPS, COCKS, PERCOLATORS, AIR-TIGHT JARS,

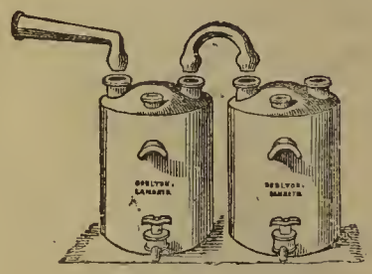
AND EVERY DESCRIPTION OF

STONEWARE FOR CHEMICAL PURPOSES,

Warranted to Resist the Strongest Acids.







PLUMBAGO CRUCIBLES, AND OTHER FIRE-STANDING GOODS.

CHEMISTS' AND DRUGGISTS' GLASS. PORCELAIN TAPS.

PRICE LISTS of any of the above, and of Every Description of Stoneware, may be had on application, and Samples seen at

Messrs. D. and W.'s SHOW ROOMS, HIGH STREET, LAMBETH.

Just published, 2nd Edition, 594 pp., 8vo., price 12s. 6d.

ORGANIC MATERIA MEDICA.

BY DR. MUTER.

Analytical Chemists will find this a concise and yet complete book of reference for the isolation and examination of the active principles of drugs. Special appendix on the microscopic characters of the starches in food and drugs. Copious index and qualitative courses or resins, &c.

Published by W. BAXTER at the Office of the South London Schoo of Pharmacy, Kennington Cross, S.E., and sold by Messrs. Simpkin and Marshall and Messrs. Baillière, Tindal, and Cox.

JAMES WOOLLEY, SONS, & CO.

69, MARKET STREET, MANCHESTER,

DEALERS IN

CHEMICAL AND SCIENTIFIC APPARATUS CHEMICAL REAGENTS, &c.,

FOR THE USE OF

ANALYSTS, SCIENCE TEACHERS, AND MANUFACTURERS

Price Lists on application

FACTORIES
Reddish and Bradford,
MANCHESTER.

CHARLES LOWE & CO.,

(ESTABLISHED 1860.)

TOWN OFFICES:
61, Piccadilly,
MANCHESTER.

MANUFACTURERS OF

PURE CARBOLIC ACID, Cryst. at 42°·2 C.	Discovered by C. Lowe.	CARBOLIC ACID GLYCERINE SOLUTIONS.
,, ,, do. Hydrate of		CRESYLIC ACID.
MEDICINAL do. Cryst. at 35° C.		SULPHO-PHENIC ACID (CRYST.
COMMERCIAL do. No. 1 ,, 35° C.		SULPHO-PHENATES & SULPHO-CRESYLATES OF SODA, POTASH, ZINC, IRON, and ALUMINA.
,, do. 2 ,, 29° C.		
,, do. 3 ,, 12° C.		
,, do. 4 liquid at 0° C.		
CARBOLIC ACID DISINFECTING POWDER.		

BENZOL (Cryst.).
ANTHRACENE.
NAPHTHALINE.
PICRIC ACID (Crystal and Paste).
AURINE (Rosolic Acid) Cake and Solution.

C L & Co. beg to state that, not cultivating a Retail Trade, they are in a position to offer the most favourable terms to Wholesale and Export Houses.

JOHN CLIFF,

STONEWARE MANUFACTURER,

Late JOHN CLIFF & Co.
Formerly STEPHEN GREEN.
IMPERIAL POTTERIES,
LAMBETH.

OLD QUAY RUNCORN.

London: Printed and Published for the Proprietor by EDWIN JOHN DAVEY, at the Office, Boy Court Ludgate H E.C
June 28, 1878.

THE CHEMICAL NEWS.

VOLUME XXXVII.

EDITED BY WILLIAM CROOKES, F.R.S., &c.

No. 945.—JANUARY 4, 1878.

LIQUEFACTION OF OXYGEN.*

By M. RAOUL PICTET.

The object which I have had in view for more than three years is to demonstrate experimentally that molecular *cohesion* is a general property of bodies, to which there is no exception.

If the permanent gases are not capable of liquefying, we must conclude that their constituent particles do not attract each other, and thus do not conform to this law.

Thus, to cause experimentally the molecules of a gas to approach each other as much as possible, certain indispensable conditions are necessary, which may be expressed thus :—

1. To have the gas absolutely pure, with no trace of foreign gas.
2. To be able to obtain extremely energetic pressures.
3. To obtain intense cold, and to subtract heat at these low temperatures.
4. To utilise a large surface for condensation at these low temperatures.
5. To be able to utilise the rapid expansion of the gas from extreme condensation to the atmospheric pressure—an expansion which, added to the preceding means, will *compel* liquefaction.

Having fulfilled these five conditions, we may formulate the following alternative :—

When a gas is compressed to 500 or 600 atmospheres, and kept at a temperature of $-100°$ or $-140°$, and it is allowed to expand to the atmospheric pressure, one of two things takes place :—

Either the gas, obeying the force of cohesion, liquefies, and yields its heat of condensation to the portion of gas which expands and loses itself in the gaseous form; or, on the hypothesis that cohesion is not a general law, the gas must pass to the absolute zero and become inert,—that is to say, an impalpable powder.

The work done by expansion will not be possible, and the loss of heat will be absolute.

Struck with the truth of this alternative, which is rendered certain by thermo-dynamic equations based on accurate data, I have sought to produce a mechanical arrangement which should entirely satisfy these different conditions, and I have chosen the complicated apparatus of which the following is a brief description :—

I take two pumps, P_3 and P_4, for exhaustion and compression, such as are used industrially in my ice-making apparatus. I couple these pumps in such a way that the exhaustion of one corresponds to the compression of the other. The exhaustion of the first communicates with a tube (R) of 1·1 metres long and 12·5 centimetres in diameter, and filled with liquid sulphurous acid. Under the influence of a good vacuum the temperature of this liquid rapidly sinks to $-65°$, and even to $-73°$, the extreme limit attained.

Through this tube of sulphurous acid passes a second smaller tube (S), of 6 centimetres diameter, and the same length as the envelope. These two tubes are closed by a common base.

In the central tube is retained compressed carbonic acid produced by the reaction of hydrochloric acid on Carrara marble. This gas, being dried, is stored in an oil gasometer (G) of 1 cubic metre capacity.

At a pressure of from 4 to 6 atmospheres the carbonic acid easily liquefies under these circumstances. The resulting liquid is led into a long copper tube (B), 4 metres in length and 4 centimetres in diameter.

Two pumps, P_1 and P_2, coupled together like the first, exhaust carbonic acid either from the gasometer (G) or from the long tube (B) full of liquid carbonic acid.

The ingress to these pumps is governed by a three-way tap, H. A screw valve cuts off at will the ingress of liquid carbonic acid in the long tube; it is situated between the condenser of carbonic acid and this long tube. When this screw valve is closed, and the two pumps draw the vapour from the liquid carbonic acid contained in the tube 4 metres long, the greatest possible lowering of temperature is produced; the carbonic acid solidifies and descends to about $-140°$. The subtraction of heat is maintained by the working of the pumps, the cylinders of which take out 3 litres per stroke, and the speed is 100 revolutions a minute.

Both the sulphurous acid tube and the carbonic acid tube are covered with a casing of wood and non-conducting stuff to intercept radiation.

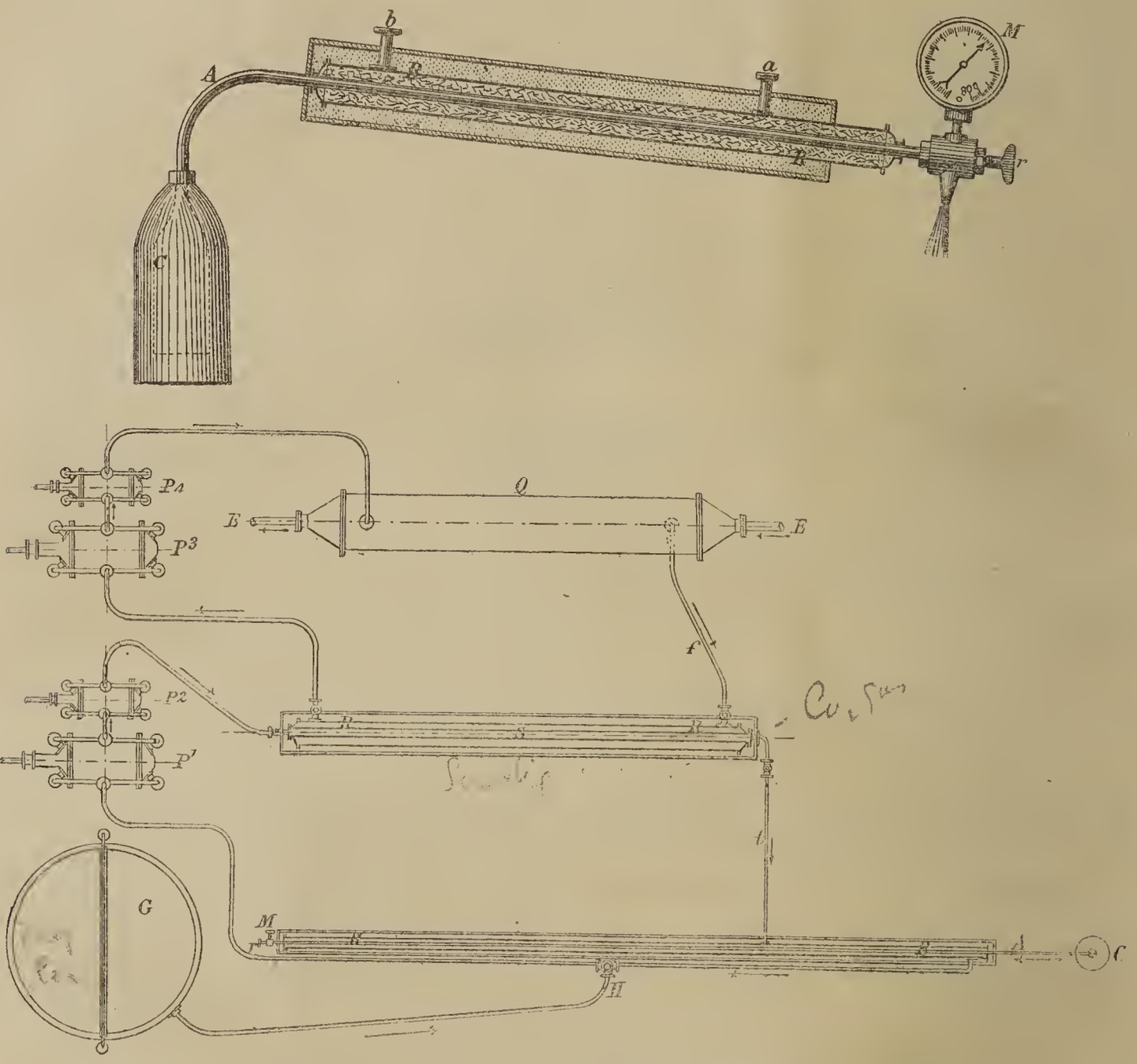
In the interior of the carbonic acid tube, B, passes a fourth tube, A, intended for the compression of oxygen; it is 5 metres long and 14 millimetres in external diameter. Its internal diameter is 4 millimetres. This long tube is consequently immersed in solid carbonic acid, and its whole surface is brought to the lowest obtainable temperature. These two long tubes are connected by the ends of the carbonic acid tube, consequently the small tube extends about 1 metre beyond the other. I have curved this portion downwards and given the two long tubes a slightly inclined position, but still very near the horizontal, as I have shown in the accompanying drawing.

The small central tube is curved at A, and screws into

* The *liquefaction of oxygen* is so important a scientific achievement that we have much pleasure in laying before our readers the following detailed account of the means employed and diagrams of the apparatus used, which have been communicated to us by M. Pictet himself.—Ed. *C. N*

he neck of a large howitzer shell, C, the sides of which are 35 millimetres thick; the height is 28 centimetres, and the diameter 17 centimetres.

This shell contains 700 grms. of chlorate of potash and 256 grms. of chloride of potassium mixed together, fused, then broken up, and introduced into the shell perfectly dry. When the double circulation of the sulphurous and carbonic acids has lowered the temperature to the required degree, I heat the shell over a series of gas-burners. The decomposition of the chlorate of potash takes place at first gradually, then rather suddenly towards the end of the operation. A pressure-gauge, M, at the extremity of



Description of the Drawings.

A. A tube, 5 metres long, 14 millimetres external diameter, and 4 millimetres internal diameter, in which the oxygen condenses. It is furnished with a screw-tap, *r*, from which the liquid oxygen jets out. A pressure-gauge, M, measures the pressure up to 800 atmospheres.

B. A tube, 4 metres long, in which is solid carbonic acid. The stock of carbonic acid is contained in a gasometer, G, of 1 cubic metre capacity. A three-way tap, H, puts it when desired into communication with the apparatus.

C. A howitzer shell, containing 700 grms. of chlorate of potash mixed with chloride of potassium. It is heated with gas.

P_1, P_2. Double-action exhaustion and force pumps, drawing carbonic acid from the tube B or the gasometer G, according to the position of the tap H.

S. A tube, 60 millimetres diameter and 1·1 metre long, in which is condensed the liquid carbonic acid compressed by the pumps. This liquefied gas returns by the small tube *t* to the tube B.

R. A tube, 125 millimetres in diameter and 1·1 metres long, containing liquid sulphurous acid.

P_3, P_4. Double-action exhaustion and force pumps, exhausting sulphurous acid gas from the tube R.

Q. A tubular condenser of sulphurous acid compressed by the pumps. This body, when liquefied, returns by the small tube *f* to the tube R. The cold water for condensing the sulphurous acid passes through the apertures E E.

a. Entry for liquid carbonic acid.

b. Exit for the vapourised carbonic acid caused by the suction of the pumps.

the long tube, lets me constantly observe the pressure and the progress of the reaction. This gauge is graduated to 800 atmospheres, and was made for me expressly by Bourdon, of Paris.

When the reaction is terminated the pressure exceeds 500 atmospheres; but it almost immediately sinks a little, and stops at 320 atmospheres. If at this moment I open the screw-tap, *r*, which terminates the tube, a jet of liquid is distinctly seen to spirt out with extreme violence. I close the tap, and in the course of a few moments a second jet —less abundant, however—can be obtaincd.

Pieces of charcoal, slightly incandescent, put in this jet inflame spontaneously with inconceivable violence. I have not yet succeeded in collecting the liquid, on account of the considerable projectile force with which it escapes, but I am trying to arrange a pipette, previously cooled, which possibly may be able to retain a little of this liquid.

Yesterday I repeated this experiment before the majority of the members of our Physical Society, and we had three successive jets, well characterised. I cannot yet determine the minimum pressure necessary, for it is evident that I have a surplus pressure produced by the excess of gas accumulated in the shell, and which could not condense in the small space represented by the interior tube.

I hope to utilise a similar arrangement in attempting the condensation of hydrogen and nitrogen, and I am especially occupied with the possibility of maintaining low temperatures very easily, thanks to four large industrial pumps which I have at my disposal, worked by a steam-engine.

Geneva, December 25, 1877.

Since receiving the above we have been favoured with further particulars of an experiment which was performed for the fourth time on Thursday, December 27th, in the presence of ten scientific men—among others, Professor Hagenbach, of Bâle, who came expressly to assist at this important experiment.

At 10 o'clock in the evening the manometer, which had risen to 560 atmospheres, sank in a few minutes to 505, and remained stationary at this figure for more than half-an-hour, showing by this diminution in the pressure that part of the gas had assumed the liquid form under the influence of the 140 degrees of cold to which it was exposed. The tap closing the orifice of the tube was then opened, and a jet of oxygen spirted out with extraordinary violence.

A ray of electric light being thrown on the escaping jet showed that it was chiefly composed of two parts;—one central, and some centimetres long, the whiteness of which showed that the element was liquid, or even solid; the other exterior, the blue tint of which indicated the presence of oxygen compressed and frozen in the gaseous state.

The success of this remarkable and conclusive experiment called forth the applause of all present.

We understand that Messrs. Pictet and Co., of 22, Rue de Grammont, Paris, are fitting up apparatus with the intention of having these experiments repeated at their Freezing-Machine Works, at Clichy, in Paris.

Liquefaction of Hydrogen and Nitrogen.—We read in *The Times* that on the morning of Monday, December 31st, 1877, in the presence of three members of the Institute, M. Cailletet effected the liquefaction of hydrogen, nitrogen, and atmospheric air, thus proving that all gases can be liquefied.

An Experiment on Betulin.—E. Paterno and P. Spica, on distilling betulin with anhydrous phosphoric acid, obtain an oily liquid, boiling between 245° and 250°, and having the composition—Carbon, 89·23; Hydrogen, 10·74.—*Gazzetta Chimica Italiana.*

NOTES ON THE CARBOLIC TEST FOR NITRIC ACID.

By DAVID LINDO.

(1.) THE deep magenta colour produced by this test disappears on the addition of water: the fluid acquires a yellowish tint, and a slight brown precipitate subsides. On evaporating the solution the red colour reappears.

(2.) Alkalies in excess change the magenta colour to green. On adding sulphuric acid again in excess the magenta colour returns.

(3.) The green coloured fluid produced by the action of alkalies in excess on the magenta can be diluted with water without suffering change. The reaction is sensitive, and useful as affording additional proof of the presence of nitric acid, which may be required where in applying the red test too much carbolic acid has been used for the quantity of nitric acid present. In this case the colour, instead of being a bright pure magenta, will incline to brown. With this reddish brown fluid the green colour can be obtained quite distinctly on addition of an alkali in excess if the original colour was caused by the presence of nitric acid. The test may be applied as follows:—

(4.) Place some solution of ammonia (*Liq. Ammon. Fort.*, diluted with 2 parts of water) in a small dish, and let one drop of the magenta-coloured fluid at a time trickle down the side of the vessel into the alkali. Some care is required, as the fluid may spirt. With the fixed alkalies no spirting occurs, but, according to my observation, the colour produced is not so fine as with ammonia. The green colour is developed immediately as the fluids come in contact, and is often very bright. Sometimes, however, it is otherwise, and I have found some magenta fluids give a yellow instead of green colour on addition of alkalies, which appears to be due to nitric acid being in excess of carbolic in the red fluid.

(5.) If some sulphuric acid is placed in a test-tube, and a small quantity of the green fluid allowed to flow a drop or two at a time gently down the side of the tube, the red colour will appear when the green fluid reaches the acid at the surface of contact.

(6.) A solution of nitre was made in the proportion of 1 grain to 160 ounces of distilled water. Half an ounce of this solution, mixed with an equal bulk of sulphuric acid, gave a reaction, though not a very distinct one, on addition of some carbolic solution. The sulphuric acid and water had been previously tested, and found free from nitric acid.

(7.) The magenta colour is developed very imperfectly or not at all if the nitric acid is very much in excess of the carbolic. Want of knowledge of this fact might lead to the inference that nitric acid was absent, or present in only minute quantity in cases where it is really in excess. With excess of carbolic the colour inclines to brown, as stated above. If these facts are borne in mind, and a little care taken in applying the test, the colour can always be obtained of great purity and beauty.

Falmouth, Jamaica, Nov. 22, 1877.

RESEARCHES ON THE PHYSIOLOGICAL FUNCTION OF VINE-LEAVES.

By Dr. H. MACAGNO

FINDING that vine-leaves contain a considerable quantity of starch, dextrin, grape-sugar, and potassium bitartrate, I was led to inquire into the conditions for obtaining these matters in the leaves, and their probable relation with the ripeness of the grape.

The following are the results of a first analysis, made on the 20th of June, 1877:—

	In 1 kilogrm. of Leaves	
	Grape-sugar. Grms.	Potass.-bitart. Grms.
Leaves of the superior part of branches with grapes	14·24	7·41
Leaves of the inferior part, ditto..	10·81	5·12
Leaves of the branches without grapes	11·93	4·91
Leaves ditto ditto ..	11·65	6·90

The following table indicates the successive degrees of this physiological work, as shown by analysis, on the leaves and on the grapes, during the vegetation progress, at different times :—

	In 1 kilogrm. of Leaves taken at the end of branches with fruits.		Grape-sugar in 1 kilogrm. of	
	Grape-sugar. Grms.	Potass.-bitart. Grms.	Grapes. Grms.	Stones. Grms.
June 20	14·24	7·41	—	—
August 4 ..	15·31	12·52	9·41	10·00
,, 16 ..	15·96	11·84	33·67	34·14
,, 31 ..	16·62	12·29	66·19	81·66
September 15	20·50	—	91·15	112·00
Oct. 5 (vintage)	23·70	—	117·41	128·15
October 12 ..	19·04	—	—	—

These facts lead to the conclusion that the grape-sugar and tartaric acid are chiefly formed in the superior leaves of the branches having fruit; and the last table shows that this sugar-production increases as the grapes increase in ripeness, and that it diminishes after vintage. I have also found grape-sugar in the branch itself bearing fruits, the leaves of which have been analysed. A very small quantity of starch and dextrin is found in the branches, while, on the contrary, they abound in the leaves. This is shown in the following results of analyses made with 4 kilogrms. of leaves and 4 kilogrms. of branches :—

	Leaves. Grms.	Branches. Grms.
Grape-sugar per kilogrm, ..	11·28	8·25
Starch and dextrin ditto ..	3·77	0·98

For it, I am induced to behold the leaves as the laboratory for the grape-sugar production, and the young branches as conductors of this very precious grape element. I think that such a function of the vine-leaves explains the bad effects resulting from nipping off the vines during the estival season. This is shown also by Guyot, in his "Etudes des vignobles de France" (vol. iii., p. 295). He observed in the Vosges Department a delay of ten days in the ripening of the grapes, in consequence of the vines having been nipped.

I have obtained the same results by practical experiment in this country. Twenty vines were nipped on the 7th of July, 1877; the others of the same vineyard remained in their natural condition. On the 26th of September the analysis of the grapes gave me the following results :—

	From the Nipped Vines.	From the Unnipped Vines.
	Grms.	Grms.
Must in 1 kilogrm. of grapes..	581	620
Grapes without stones ditto ..	54	46
In the Must.		
Specific gravity	1·069	1·075
Grape-sugar per cent	14·000	17·541
Total acidity ditto	1·400	1·320
Fixed matters ditto	21·750	21·950
Potassium bitartrate ditto ..	1·308	1·306

By nipping we have therefore lost 3½ per cent of grape-sugar in the must, and about 4 per cent of must in the grape. The nipping is useful if the vines do not bear well, or if the climate is rather cold; but where the production is abundant nipping should be attended with great care.

Gattinara (Italy), October 20, 1877.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, December 20, 1877.

Dr. J. H. Gladstone, F.R.S., President, in the Chair.

After the visitors had been announced, the minutes confirmed, and a list of presents to the library read, the following certificates were read for the first time :—G. S. Taylor, G. H. Spring, J. V. Elsden, A. H. Hooker.

The first paper was "*On the Bromo-derivatives of Camphor*," by Dr. Armstrong and Mr. Matthews. In preparing mono-brom-camphor the authors find that it is merely necessary to add the requisite amount of bromine to the camphor heated in a water-bath, care being taken to add only a small quantity of bromine at first; heat is then applied to effect the decomposition of the resulting dibromide; on further addition of bromine the decomposition proceeds in a perfectly regular manner. The product is purified by washing with an alkali and re-crystallisation from alcohol. By the action of agents which convert camphor into cymene, bromo-camphor is apparently completely decomposed. It is readily oxidised by nitric acid, sp. gr. 1·3, furnishing much camphoric acid, and a magnificently crystalline body, at present under investigation. The authors find that if bromine be added to camphor (2 molecules of the former to one of the latter) and the mixture heated for a short time in the water-bath, dibrom-camphor is obtained, melting at 57° to 58°, in colourless glistening prisms; this substance is dissolved, and decomposed by nitric acid, sp. gr. 1·4, furnishing a neutral substance with properties far less characteristic than the product from mono-brom-camphor, but no camphoric acid.

The next communication was "*On the Action of Iodine on Camphor*," by Dr. Armstong and Mr. Easkell. The authors have investigated the so-called camphin of Claus, which they obtained in quantity as a by-product in preparing carvacrol from camphor by Fleischer and Kekulé's method. After extracting the carvacrol with sodic hydrate a current of steam was passed through the residue; the distillate freed from camphor by extraction with dilute sulphuric acid (5 acid, 2 water) was re-distilled in presence of sodium. In fractionating the product the authors found a slightly modified form of Le Bel and Henninger's fractional distillation apparatus of the greatest use. (It can be obtained from Messrs. Cetti.) Almost the whole passed over between 115° and 215°; the quantity below 160° was small. The quantity between 160° and 168° was very considerable; on examination it was found to be in all probability the hydrocarbon, $C_{10}H_{20}$, but resembles in some respects the paraffin, $C_{10}H_{22}$. The next considerable fraction boiled at 174° to 176°; it consisted chiefly of cymene. The higher portions which, in the aggregate, constitute a by no means unimportant proportion of the entire product, contained much laurene of Fittig, Köbrich, and Jilke, and one if not two hydrocarbons. The authors are continuing these investigations, and Dr. Armstrong stated that he had made much progress in the examination of the mixtures of hydrocarbons obtained from camphor by the action of the so-called dehydrating agents, for in no case, apparently, is cymene the only product; he proposes also to repeat Weyl's experiments on the action of hydriodic acid on camphor, and to prepare hydrides from cymene.

The third paper was read by Dr. Armstrong "*On the Constitution of Terpenes and of Camphor.*" In the author's opinion the generally received hypothesis that the terpenes are dihydrides of cymene is quite irreconcileable with their properties. They do not yield acids related to the hydrocarbons of the benzene series in any quantity on oxidation, neither do they furnish characteristic nitration products; moreover, they combine with

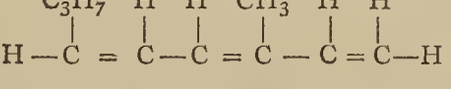
bromine with great facility, they unite with the haloid acids at ordinary temperatures, and combine with water, forming compounds such as terpin, $C_{10}H_{18}(OH)_2$. A dihydride of cymene might be expected on oxidation to lose the "added" hydrogen, to have its side chains affected, but the formation of compounds whose constitution is probably (Mielák and Williams) diaterebic and terebic acids, is quite without analogy. The readiness with which the terpenes undergo isomeric change and are polymerised is also at variance with the above hypothesis. The evidence as to the real constitution of the terpenes is at present extremely unsatisfactory, and insufficient; their conversion into cymene and behaviour on oxidation, the two most important elements for discussion, involving apparently opposite conclusions. The facility with which they form additive compounds tends, however, to support the conclusions derived from their behaviour on oxidation, *i.e.*, that they do not contain a closed chain of six carbon atoms, and if this be the case cymene is doubtless the end product of a series of changes; whether the carbon atoms are all united in an open chain or partially in a closed chain of perhaps fewer than six seems quite uncertain. The evidence as to the constitution of camphor is equally incomplete; it is by no means established that camphor and the terpenes are so closely related as has been supposed. There is little doubt that it does not belong to the alcohols or aldehyds, but probably contains oxygen in the form in which it exists in ethylene oxide or in the ketones. From the fact that *homologous hydrocarbons* are formed with cymene by the action of the so-called dehydrating agents and other considerations, the author concludes that camphor does not contain a cymene nucleus in which the propyl and methyl groups are relatively in the para position. No formula hitherto proposed explains satisfactorily the ready formation of an anhydride from camphoric acid. In conclusion the author states that the evidence as to the constitution of terpenes and of camphor is very conflicting, but that from their entire behaviour these bodies appear to be compounds of an altogether peculiar constitution.

The President remarked that as Dr. Tilden had a paper on a similar subject he would ask him to read it before any discussion took place on the papers which had just been read.

Dr. Tilden accordingly read his paper "*On the Hydrocarbons Obtained from Pinus Sylvestris, with Remarks on the Constitution of the Terpenes.*

1. *Russian Turpentine Oil.*—Obtained as a by-product during the distillation of wood, chiefly that from *P. sylvestris* and *P. Ledebourii*, for the purpose of preparing tar; sp. gr. 0·8682; 100 m.m. rotated 17° to the right. It had a yellowish colour and pleasant odour. After removing small quantities of acetic acid and creosote it was distilled, four principal ingredients beingultimately obtained. 10 to 15 per cent of a terpene boiling at the same temperature as australene (156°) and identical with it chemically; 100 m.m., however, rotate +23·3°. About 66 per cent of a terpene boiling at 171° having a characteristic odour, rotation +17°, sp. gr. 0·86529 at 15°. The remaining ingredients consisted of about 7·5 per cent of cymene, and a terpene boiling 173° to 175°. No solid hydrochloride could be obtained from this terpene, nor any crystalline nitroso-chloride. In addition to the above ingredients the oil contains small quantities of viscid hydrocarbons having high boiling-points.

2. *Oleum Foliorum Pini Sylvestris.*—Obtained by distilling the leaves of the Scotch fir with water; sp. gr. 0·8756; rotation +5° 30'. By careful fractionation two terpenes, corresponding in boiling-point with those above described, the first boiling at 156° to 159°, rotation +18° 48'; in odour it resembles common turpentine, the second constituting two-thirds of the oil, boils at 171°; rotation −4°; sp. gr. 0·86529; no solid hydrochloride could be prepared. In addition, a little cymene and some pleasant-smelling liquids of higher boiling-point were obtained. The author then proceeded to discuss the constitution of the terpenes, and pointed out that there are probably only 3 isomerides amongst the natural terpenes, differing in odour, action on polarised light, &c., which differences can be accounted for without assuming any but mechanical differences of constitution. Thus we have terpenes from American and Russian turpentine with that from the oil of the leaf of *Pinus sylvestris* all boiling at 156° to 159°, sp. gr. 0·860, and dextro-rotatory. The terpenes from French turpentine, oil of sage, and oil of juniper, have the same boiling-point, but are lævo-rotatory. The above form the first group, and all yield the same nitroso-derivatives; terebene probably belongs to the same group. The members of the second group boil at 174°, sp. gr. 0·85, and yield the same nitroso-substitution compounds; they are obtained from the oils of bergamot, sweet orange-peel, lemon, and caraway, and are all dextro-rotatory. The third class comprises the two terpenes of higher boiling-point, 171° to 173°, described above, as obtained from Russian turpentine (probably Atterberg's Sylvestrenes) and oil of *P. sylvestris*, sp. gr. 0·865; yield no crystalline mono-hydrochloride or nitroso-chloride. All terpenes yield by the action of bromine *a*-cymene, *i.e.*, methyl-propyl-benzene. By oxidation they furnish carbonic and acetic acids; cymene will not combine with hydrogen to produce a terpene; terebene has been obtained from diamylene by removing 4 atoms of hydrogen. From a consideration of the above facts the author suggests the formula—



for *a* terpene. Similarly, by shifting C_3H_7 and CH_3 one atom of carbon to the right, the formula of *β*-terpene is obtained, whilst by shifting the propyl and methyl groups two atoms in the carbon chain, that of *γ*-terpene. These three formulæ furnish a cymene identical in each case. As regards camphor, the author is disposed to consider it as a benzene or cymene derivative, notwithstanding the fact that he has represented the terpenes as consisting of an open chain of carbon, the reasons for which constitution conclude his paper.

The President thought that it would be convenient to discuss the new facts brought forward by Dr. Tilden before proceeding to any arguments as to the theorettical views propounded by him. He was interested to know if the mechanical differences existing in the structure of the various members of the terpenes involved any difference of odour, or whether the odour was due to oxidised substances.

Dr. Wright had some hesitation in accepting only three modifications of the terpenes. Thus, the oils of orange-peel and lemon were classed together; yet whilst the former yielded 80 to 90 per cent of cymene, the latter furnished only 15 to 20 per cent. Moreover, their boiling-points were 2° to 3° apart, and admitting there were at least four terpenes, it was difficult to see how the proposed formula could form the same cymene by a simple reaction.

Mr. Kingzett agreed generally with Dr. Tilden, but pointed out that all terpenes by oxidation formed peroxide of hydrogen, and that cymene similarly yielded peroxide of hydrogen. On the whole, he was inclined to believe that terpenes were dihydrides of cymene. He had found on oxidising large quantities of oil of turpentine that the American oil oxidised slowly; the Russian oxidised four times as quickly; whilst the Swedish was still swifter. The French oxidised at about the same rate as the Russian. The purer the oil the less readily did it oxidise. Camphor he regarded as resembling the alcohols in its constitution. The constitution as expressed by structural formulæ only represents the way in which a body splits up when subjected to a certain mode of decomposition, and as the products differ with the mode, the derived formulæ cannot represent true constitution.

Dr. TILDEN, in reply to Dr. Wright, thought that the difference in the yield of cymene from the oils of lemon and orange was due rather to a difference in mechanical that in chemical constitution.

Dr. WITT pointed out that one benzo-phenol was converted into its isomer with great evolution of heat, so that here, then, was an instance of two isomers having a different physical constitution.

Dr. ARMSTRONG objected to dividing the terpenes into three classes, because there were the camphenes, which must constitute a fourth class. The formula of diamylene, on which Dr. Tilden founded his formula of terpene, was not by any means established. That Dr. Tilden's formula only accounted for three classes of terpenes he regarded as but a slight objection. There was no doubt that our present formulæ were insufficient.

The PRESIDENT said that such discussions were valuable, not only for adding to our knowledge, but for revealing our ignorance. It would be necessary, as science advances, to revise our theories. Our present formulæ simply represented our present state of knowledge, and we must not expect them to survive, but to change for something more true and more perfect. Another point raised was how far we are to distinguish between the chemical and the mechanical structure of a body. After some remarks as to value and interest of the physical properties of a body, Dr. Gladstone concluded by stating that if cymene was contained in the terpenes he should have expected their dispersion to have been higher.

The next paper was "*On Citric Acid as a Constituent of Imperfectly Ripe Mulberry Juice*," by Dr. WRIGHT and Mr. PATTERSON. A large quantity of unripe mulberries was expressed, furnishing a turbid light brown liquid, having a very acid taste. This was subjected to analysis, and found to contain 70·16 grms. of total solids per litre. The solid matter consisted of citric acid, 26·83 grms.; malic acid, 7·82 grms.; glucose, 2·74 grms.; ash, 9·4 grms.; mucilage, pectin, &c., 23·37 grms. per litre. The presence of citric acid was confirmed by the preparation and analysis of the lime-salt. In conclusion the authors point out that the juice of imperfectly ripe mulberries, as it contains such a quantity of citric acid, and 3·26 grms. per litre of potash salt (calculated as carbonate), may be valuable as an antiscorbutic and as a substitute for lime-juice.

The next communication was made by Mr. THOMAS, "*On Cuprous Chloride, and the Absorption of Carbonic Oxide and Hydrochloric Acid Gas.*" The author, after many trials, found the following method for the preparation of the solution of cuprous chloride to give the best results. A long narrow 4-ounce stoppered bottle is filled three parts full with copper-turnings; 6 grms. of ordinary hydrous cupric chloride and 20 c.c. of strong hydrochloric acid are introduced, and the bottle shaken until the $CuCl_2$ is dissolved. 10 c.c. of water are run in so as to float on the acid liquid; the bottle is then violently shaken. The solution becomes colourless instantly, and after the addition of 30 c.c. of water is ready for use. The author finds that such a solution absorbs carbonic oxide with facility, but that when the free hydrochloric is afterwards suddenly neutralised with potassic hydrate as much as 63 per cent of the carbonic oxide is again liberated, and will remain unabsorbed. If the neutralisation be effected slowly, about 4 per cent only will be set free. To avoid any error from this reaction the author neutralises the hydrochloric acid with ammonia before introducing the cuprous chloride solution. He prepares this solution thus:—Some of the above cuprous chloride solution is poured into a small porcelain crucible, and to it is added, by means of a fine pipette, ammonia (1 of 880 to 1 of water) until the slightest shade of blue remains permanent. This solution is introduced at once into the absorption-tube. By this method neither free ammonia nor free acid is introduced, whilst the reagent absorbs carbonic oxide nearly as well as the original acid solution. The absorption is complete in half an hour. It is stated (Sutton's "Volumetric Analysis," p. 367) that sodic phosphate and sodic sulphate owe their absorbent powers, for hydrochloric acid gas, to their water of crystallisation. The author has found that this is not the case, but that these substances form with HCl acid salts and sodic chloride. Ammonic sulphate in saturated solution is, however, the most convenient reagent, and by adding an equal volume of such a solution to the above cuprous chloride solution the hydrochloric acid is neutralised without the liberation of any carbonic oxide. Or the solutions can be mixed before introducing them into the absorption-tube, as the mixture absorbs carbonic oxide with facility.

After the thanks of the meeting had been given to the authors for their respective communications, the Society adjourned to January 17, when the following papers will be read;—"On the Action of Reducing Agents on Potassium Permanganate," by F. Jones: "On the Alkaloids of the Aconite Family: Part II., Alkaloids of Aconitum ferax," by Dr. Wright and Mr. Luff; "On the Action of Sulphuric Acid on Copper," by Spencer Pickering.

DEUTSCHE CHEMISCHE GESELLSCHAFT, BERLIN.

November 26, 1877.

Professor C. LIEBERMANN, Vice-President, in the Chair.

THE following communications were presented:—

A. SAUER and E. ADOR, "*Determination of Nitrogen in the Nitro-Glycerin of Dynamite.*"—The authors find that the only reliable method for analysing nitro-glycerin is to determine the N by Dumas's method, the necessary amount for combustion being dropped into a weighed amount of fine cupric oxide, which is mixed and inserted into the combustion-tube. By this process 18·5 per cent of N is found, which coincides with the trinitro compound. Schlösing's process for determining N as NO, by treatment with an excess of HKO, yielded but 12·5 per cent. By treating with soda-lime, but 3 per cent of N was obtained as NH_3. Experiments showed that, in contact with alkalies, nitro-glycerin invariably gave rise to NH_3, as well as HNO_3—a fact which explains the incorrect results often obtained hitherto in the determinations of explosive mixtures.

M. TRAUBE defends his "*Chemical Theory of Fermentation*" against the theory offered by Hoppe-Seyler to explain this operation, in which the hypothesis is advanced that the H liberated by decomposing substances attacks the molecules of O in the air, uniting with one atom and freeing the other, which possesses the properties of ozone and causes the accompanying phenomena of oxidation. The author gathers together a number of facts to prove that these latter phenomena never occur in fermentation processes except in the presence of certain agents which serve for the transfer of O, in a manner exactly analogous to the oxidations caused by platinum black in inorganic chemistry.

F. BEILSTEIN and A. KURHATOW, "*Action of Sulphuretted Nitrogen on Nitro-Compounds.*" It is ascertained that H_2S (or KHS, or K_2S) does not reduce dinitro bodies, a reaction beginning only on the addition of NH_3, and the resultant $(NH_4)_2S$ giving rise then merely to substitution products. Dinitro-chloro-benzene (53°) gave in this way tetra-nitro-phenyl-sulphide $[C_6H_3(NO_2)_2]S$, crystallising in yellow needles, exceedingly insoluble in the usual solvents, and forming a sulphone by treatment with HNO_3. Nitro-para-dichloro-benzene yielded similarly $[C_6H_3Cl(NO_2)]_2S$ with K_2S, and chloro-nitro-phenyl-mercaptan, $C_6H_3(SH)Cl(NO_2)$, with H_2S.

F. KESSEL, "*Action of Bromine and Chlorine on Chlor*

ethyliden-acetate." By treatment with bromine at 100° the author obtains dibrom-acetic ether,—

$$CH_3.CO.OCHBr.CH_2Br,$$

an oily colourless liquid, decomposing by distillation, and yielding, on treatment with water, acetic acid, crotonic aldehyd, and HBr. Chloro-ethyliden-acetate yields, with Cl at 120° in the presence of iodine, a similar liquid—trichlor-acetic ether, $CH_3.COO.CHCl.CHCl_2$.

C. Liebermann and H. Wichelhaus present, in two papers, their theoretical considerations "*On the Formula of Quinhydrone*," the first advocating $C_{12}H_{10}O_4$, the second $C_{18}H_{14}O_6$.

R. Nietzki decides the question by quantitatively determining the amount of H necessary to reduce quinhydron to hydroquinon, by means of sulphurous acid and an iodine solution. Eight experiments gave results coinciding with the formula—

$$C_{12}H_{10}O_4 - C_{12}H_{10}O_4 + 2H = 2C_6H_6O_2,$$

so that quinhydron must be considered as resulting from the union of 1 mol. quinon and 1 mol. hydroquinon.

H. Hunnius, "*Derivatives of Aceto-phenon*." Aceto-phenon-bromide, $C_6H_5.CO.CH_2Br$, results from the action of Br on acetophenon, and forms crystals 2 inches in length. With HNO_3 it gives nitro-aceto-phenon-bromide.—

$$C_6H_4NO_2.CO.CH_2Br,$$

—fine needles, melting at 96°,—which is reduced to $C_6H_4NH_2.CO.CH_2$, and oxidised to meta-nitro-benzoic acid. The bromide yields the acetyl and benzoyl compounds $C_6H_5.CO.CH_2O_2C_2H_3$, &c., on treatment with the respective K salts and alcohol. The former gives rise to aceto-phenon-alcohol, $C_6H_5.CO.CH_2OH$, on heating with Na_2CO_3. A dibromide, $C_6H_5.CO.CHBr_2$, is obtained by adding 2 mols. Br to the solution of aceto-phenon in CS_2. It is oxidised to benzoic acid, and with HKO gives benzoyl-formic acid.

R. Nietzki obtains "*Methyl-quinizarin*," $C_{15}H_{10}O_4$, by the action of H_2SO_4 on hydro-toluquinon, at 130° to 150°. It is of a deep red colour, melts at 160°, is more soluble than quinizarin, and crystallises in long crooked needles. Oxidation yields anthr aquinon-carbonic acid and anthraquinon.

A. Naumann, "*Distillation of Aromatic Bodies with Aqueous Vapour*." Nitrobenzene, ethyl-benzoate, and naphthalene, as well as ethyl-bromide, when distilled with steam, show the same peculiarities as the other liquids lately examined by the author, viz., a constant boiling-point which is below that of either water or the other liquid present, and a constant ratio between the quantities of the two liquids in the distillate. It is further ascertained that the ratio between the quantities of water and the accompanying liquid in the distillate, expressed in the molecular weights, is equal to the ratio between the vapour tensions of the two liquids at the temperature of cbullition of the mixture. This fact naturally opens the way to a new method of determining molecular weights, which the author intends to develop.

F. König and L. Mutschler, "*Estimation of Free Oxygen in Well-Water*." The authors find Schützenberger's method (with sodium hydrosulphite, ammoniacal copper solution, and indigo solution) undesirable on account of the rapid decomposition of the standard solution, the difficulty of establishing its titre, and the unreliable results when large amounts of O are present. Mohr's process (union of the O with FeO and titration with permanganate) is much more exact, certain, and rapid. The amount of O present in well-water is found to vary according to the season, being 6 to 6·5 c.c. per litre in April and May, 3 to 3·5 in July and August, and 8 to 10 in October and November.

A. Baur and J. Schuler have succeeded in a "*Synthesis of Pimelic Acid*," by the simultaneous action of KCy and KHO on amylen-dibromide—

$$C_5H_{10}(CN)_2 + 2KHO + 2H_2O = C_5H_{10}(COOK)_2 + 2NH_2.$$

T. H. Dietl and V. Merz, "*Derivatives of Oxynaphthoquinon*." These consist of the bromine compound $C_{10}H_4Br(OH)O_2$ and an analogous nitro-compound, both obtained in the usual way, handsomely coloured, and possessing unusual crystalline properties.

F. Krafft obtains, by the "*Distillation of Castor Oil in a Partial Vacuum*," a new fatty acid, $C_{11}H_{20}O_2$, melting at 24·5°, and boiling at 200° under a pressure of 90 m.m.

W. V. Miller finds "*Mcthyl-crotonic Acid*" among the products of the oxidation of valerianic acid with potassium permanganate.

H. Beckurts and R. Otto, "*α-Dichloro-propionic Acid*." By heating with H_2O in closed tubes at 150° this acid is decomposed into pyruvic acid—

$$C_3H_4ClO_2 + H_2O = C_3H_4O_3 + 2HCl.$$

In contact with an excess of Ag_2O the acid yields CO_2 and $C_2H_4O_2$ only, and no carbacetoxylic acid as claimed by Klimenko. α-dichloro-propionic acid is found to solidify at −3°.

"*Dichloro-propionitrile*." By the action of Cl on propionitrile a solid and a liquid dichloro-propionitrile are obtained. The former can be changed into the latter by heating with alkaline metals or sodium amalgam, or by standing for several months.

L. Henry, "*Ethcrification by Mcans of* HCl." The author considers that a carboxyl group in contact with water or alcohol forms a trihydroxidc, as $CH_3.C(OH)_3$ or $CH_3.C(OH)_2OC_2H_5$. The latter in contact with HCl forms $CH_3C(OH)Cl(OC_2H_5)$, but as it is impossible for OH and Cl to be united to the same C atom, it decomposes into HCl and—

$$CH_3.C\begin{cases}O\\OC_2H_5.\end{cases}$$

P. Schwebel obtains "*Phenyl-hydantoïn*,"—

$$CO\begin{cases}NH.CO\\N.C_6H_5.CH_2,\end{cases}$$

by heating phenyl-glycocoll and urea together at 160°. It crystallises in long colourless needles, melting at 192°, and is easily soluble. The compound is also formed by bringing together in water, potassium cyanate, ammonium sulphate, and phenyl-glycocoll. All attempts to prepare the corresponding phenyl-hydantoic acid failed.

CORRESPONDENCE.

BUTTER ANALYSIS.

To the Editor of the Chemical News.

Sir,—The disadvantage of Hehner and Angell's process for determining the percentage of insoluble fatty acids in butter and in other fats, as originally devised by them, was the fact that portions of the melted fatty acids were liable to pass through the filter-paper.

The disadvantages of Dr. Muter's process, on the other hand, are:—

1. The great quantity of water, and therefore great length of time, required for washing the fatty acids. This is doubtless due to the deposition, on cooling, of part of the soluble acids previously dissolved by the hot water, on the under side of the cake of insoluble acids.

2. Cooling the flask each time the acids are washed takes up time.

3. The difficulty of drying the fatty acids. The melted fatty acids in the platinum dish always have (when Dr. Muter's process is employed) a considerable globule of water under them. This water is prevented from evaporating by the layer of fatty acids over it, and either remains undiminished for hours at 100°, or boils at higher temperatures with violent bumping, and consequent loss of fatty acids. It is impossible to get rid of the water by previous draining of the cake, which during its formation encloses water in cavities of its mass.

What is wanted is a simple plan by which the solution of soluble acids can be separated while hot, and without the use of a filter, and this can be done quite satisfactorily by means of a stop-cock flask, devised by my assistant, Mr. Herbert Robson, B.Sc. Lond., and represented in the accompanying woodcut. It holds about 300 c.c. The method of procedure is as follows:—

About 10 grms. of tared dry butter fat are saponified in a 12—16 oz. German flask in the usual way, and the alcohol is expelled. Up to this point, but no further, Dr. Muter's process is followed. The alcohol-free soap is now transferred, as hot as possible,* into the stop-cock flask. Here the soap is decomposed by a sufficient quantity of moderately dilute hydric sulphate, previously put into the flask, and still retaining a good deal of the heat evolved on diluting the acid.

Note.—If the hydric sulphate is put in after the soap some of the fatty acid sticks in the part of the flask marked B in the figure, and is difficult to dislodge.

The flask is now left to stand (best all night) until the turbid liquid in it has cleared, and the layer of acids on the surface solified to a cake.† The liquid is now run off through the stop-cock, the flask is half filled with scalding water, and the fatty acids are washed by rotating the contents of the flask, as recommended by Dr. Muter, for two or three minutes. The flask is then left to stand. By the time the rotation has ceased all the fatty acid will have risen to the surface, and as much as possible of the wash-water (which is at about 70°) is then run off through the stopcock. The washing with scalding water is then immediately repeated.

When the insoluble acids are completely washed, and the last lot of wash-water has been run out, the fatty acids are allowed to cool, the formation of a cake being expedited by pouring cold water over the outside of the flask. The stop-cock is now opened, and the cake is allowed to drain. The stop-cock is then shut, and the fatty acids are dissolved *in the flask* in the smallest possible quantity of ether. There will then be found under the ethereal solution nearly all the water present. This is run off by itself (as nearly as possible) into a tared platinum dish, and dried at 100°. The ethereal solution is then run into the dish, and the flask is rinsed out with ether, and the rinsings also run into the dish. The ether is then evaporated, and the fatty acids are weighed.

It will be observed that the stop-cock flask is left perfectly clean, and if the successive portions of wash-water are boiled in the saponifying flask, not only is any loss of soap prevented, but the saponifying flask too is left clean.

The stop-cock flasks are made by Messrs. Cetti and Co. The process works quite easily, and by it the determination of the percentage of insoluble fatty acids is made with accuracy and certainty. It has been employed in all the analyses of fats that have been made in my laboratory during the year, amounting to a considerable number. —I am, &c.,

W. H. CORFIELD, M.A., M.D. (Oxon).
Professor of Hygiene and Public Health, University College.

December 4, 1877.

* It is well to rinse out the flask just before use with scalding water so that it may not chill the soap.

† If the flask cannot be left long enough for the turbid liquid to clear spontaneously it may be run off, boiled, and then put back. This will very greatly accelerate its clearing.

THE INSTITUTE OF CHEMISTRY OF GREAT BRITAIN AND IRELAND.

To the Editor of the Chemical News.

SIR,—The writer is one of the many "provincial" chemists who have been anxiously watching and waiting for the definite organisation and starting of the above association, and who have all felt how desirable and necessary such a union of chemists has become. From time to time information has been given in the CHEMICAL NEWS, and recently it was announced that all was at last ready for the launch, some details being afforded as to the qualifications for election, fees, &c. But this information was not given as coming directly and officially from the heads of the new organisation, and we naturally supposed that in due course the council would publish some definite and formal announcement of the commencement of its functions, the objects proposed to be obtained, the methods by which they are to be obtained, &c., and a full list of all those chemists who have to do with the management of the affairs of the Institute, election of its Fellows, expenditure of its funds, &c. To our surprise, nothing of the sort has appeared: but in the last issue of the CHEMICAL NEWS is a note signed by Mr. Groves, as Secretary, in which he says that the association, "of which you gave some account," is incorporated, and has "begun active operations," over 300 chemists being already elected as Fellows.

Is this little note, and its almost casual allusion to the association of which you "gave some account," to be the only announcement we are to receive, and the only invitation to be issued to the profession, to come forward and give support, derive benefits, &c.? It must not be forgotten that the whole organisation has been arranged by a council of chemists in London, the great body of chemists all over the country knowing little or nothing of their doings or proposals, or even who they were. This could not well be avoided, and was doubtless the best way of getting the subject into some practical shape. But now that the long deliberations are over, is no official account of the results to be laid before the great body of chemists who know *nothing* of what these results are? It may be that some such official statement or prospectus has been issued; but if so I can only say that it has escaped the notice of very many of us. Surely it is not right, and no wise, that the first statement of the commencement o operations should reach many of us through the medium of a note of a few lines from the secretary, simply referring to "some account" given by you, and vouchsafing nothing more excepting the announcement that after February 2 the entrance fee will be raised to five guineas. This gives us some eight weeks, and we gather that the election of Fellows has been going on for some time. Hundreds of chemists probably did not know that any commencement was yet being made! Would it not be

ell to publish in the Chemical News and elsewhere very full information for all of us? How else can we obtain it?

A few of the things of which we desire a proper knowledge are as follows:—

Full list of Council and Officers.

Qualifications for election as Fellow; and what form of application must be made by candidates for that honour?

What does the Council propose to *do* to attain the objects we all so much desire? What use is to be made of the funds of the Institute, and who is to make it?

Is there going to be any publication connected with the Institute?

The names of the leaders of the new organisation, so far as we can get to know them, are a very high guarantee for the value of the privilege of fellowship, and the dignity and usefulness of the Association. But I must repeat that too many of us know nothing, and have no means of knowing anything, as to the methods by which it is proposed to benefit us and raise the standard of our profession, nor as to what we and the profession would gain by our coming forward and supporting the Institute by becoming Fellows and adding to the funds. The writer and many others, as above stated, have fully seen and acquiesced in the necessity for the organisation being formed in London, and formed quickly. But London chemists cannot alone support the Institute, and the far larger body of chemists over the country will mostly require something more definite than a few lines from Mr. Groves before they see that they have cause to come forward and give that support without which the Institute will not stand long, nor effect anything while it stands.

As one of the many, and as one who feels an earnest desire for the success of the movement, whose greatest benefits will be even more for our successors than for ourselves, I respectfully and urgently request that something more definite than a short note, casually alluding to "some account" gone before, may very soon be given to us.—I am, &c.,

Well Wisher.

Manchester, Dec. 26, 1877.

AMMONIA IN FILTERED WATER.

To the Editor of the Chemical News.

Sir,—I wish to draw the attention of analysts to a circumstance of much importance connected with the purity of water. I have lately been engaged in the analysis of a well water, the composition of which is as follows:—

	Grains per Gallon.
Lime salts, &c. (chiefly carbonate ..	9·65
Salt (NaCl)	7·96

No free ammonia, and only the smallest trace of albuminoid ammonia.

My client has been using one of the "Spongy Iron Filters" for the past six weeks, and a sample of such filtered water was also sent to me for analysis, with the following result:—

	Grains per Gallon.
Lime salts, &c.	10·30
Salt (NaCl)	7·20

And *free ammonia* 7·30 *parts per million!*

I was at a loss to understand the cause of this last and apparently serious contamination: it was clearly my duty to investigate the matter, and, if *then* a mystery, to condemn either the water or the filter. But (and I think the profession will agree with me) the cause is plain enough: iron in the presence of air and water becomes oxidised, and hydrogen is liberated, which in the *nascent* state unites with atmospheric nitrogen, and *ammonia* is formed.

I think that although a simple and natural reaction, and one to be anticipated, yet that, in the interests of the Filter Company and the profession, some note should be made of it. I may add that many repetitions were made of the analysis, and every precaution taken to avoid contamination of the water by laboratory fumes.—I am, &c.,

T. Jones.

Chemical Laboratory, 106, Leadenhall Street, December 20, 1877.

ACTION OF SUNLIGHT UPON SOLUTIONS OF OXALIC ACID.

To the Editor of the Chemical News.

Sir,—In the Chemical News (vol. xxxvi., p. 279) is a short note on the "Action of Light upon Solutions of Oxalic Acid," by Dr. Downes and Mr. T. P. Blunt, of Shrewsbury. Their observations lead to the conclusion that oxalic acid of the decinormal strength is entirely destroyed when exposed to sunlight for some time. They leave the nature of the change for a future enquiry. I can quite confirm the observation of these gentlemen, and I may state that it has been known to me for some time, as I have repeatedly made such solutions of oxalic acid for the analysis of air by Pettenkofer's method. Some solutions I have noticed keep better than others. Thus, if my memory serves me, oxalic acid made by oxidising sugar with nitric acid is more permanent in solution than that obtained by carefully re-crystallising commercial samples. In every instance where decomposition has taken place I have found the mycelium of a fungus in the liquid, and hence I have attributed the change to the action of a fungus. In order to preserve the volumetric solution, I prepare it with water containing from 10 to 25 per cent of alcohol. This I find efficacious for a period of at least four months, and, as it obviates the inaccuracies which may otherwise arise, it may be deemed of sufficient interest to warrant an insertion in your valuable journal.—I am, &c.,

W. N. Hartley.

King's College, London, December 29, 1877.

ACTION OF SUNLIGHT UPON SOLUTIONS OF OXALIC ACID.

To the Editor of the Chemical News.

Sir,—The fact that sunlight rapidly acts on solutions of oxalic acid is not quite so new as Dr. Downes and Mr. Blunt (Chem. News, xxxvi., 279) seem to believe. Most chemists who are in the habit of employing that reagent in volumetric analysis are aware that its solution should be kept in the dark. In strong sunlight the decomposition is very rapid. Thorpe, in his paper "On the Amount of Carbonic Acid in the Air of Tropical Brazils (*Journ. Chem. Soc.*, 1867) states that he was under the necessity of discontinuing the use of oxalic acid solution, as recommended by Pettenkofer, on account of the rapidity of the alteration of its titre in the strong light of the tropics.—I am, &c.,

H. P.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Academié des Sciences. No. 24, December 10, 1877.

Application of Leyden Jars of a Large Surface for Distributing the Effect of the Current from a Single Source of Electricity, and for Strengthening such Effect.—P. Jablochkoff.—The author's object is the production of an electric light at several points with a single source of electricity.

Law of the Absorption of Radiation through Bodies and on its Application in Quantitative Spectral Analysis (Second Part).—G. Govi.—Theoretic considerations, confirmed by experiment, have demonstrated to physicists that a mono-chromatic radiation, *i.e.*, one of a single wave-length, is extinguished by absorption, so that we have $I_1 = Ik^x$, I representing the intensity of the incident radiation; I_1, that of the same radiation after its passage through a thickness, x, of the absorbent medium. The magnitude k, called the coefficient of absorption, and which is always fractional, expresses the intensity of the light which has traversed the unity of the thickness of the medium. This reaction enables us to calculate the value of k for any wave-length soever as soon as we know the ratio of the two intensities $\frac{I_1}{I}$ for a thickness x of the medium traversed. When the coefficients k are once known nothing is easier than to apply them for tracing the curves of equal chromatic absorption, whether for a refraction spectrum or for the normal spectrum. For this it is sufficient to calculate x, giving to $\frac{I_1}{I}$ a constant value for all the different points of the spectrum, and employing for each point the corresponding coefficient of absorption. We may thus obtain as many points as we wish of the curve which corresponds to any intensity whatever, and construct by equidistant sections or by curves what may be called the surface of chromatic absorption in any given medium. Such researches cannot be made with an ordinary spectroscope, but a "photometer-analyser" must be applied, that is to say, an instrument by which the different simple radiations which form part of a complex radiation may be measured photometrically. If the principle of the photometer-analyser is once known, nothing is easier than to imagine for such an instrument very different arrangements which may almost equally well answer the end in view. It is sufficient to imagine a kind of spectroscope, the slit of which is divided into two parts longitudinally, and receives different radiations upon each half. If it is requisite to study absorption we leave one half of the slit free, and place before the other half a stratum of known thickness of the absorbent medium we wish to examine. The light coming from the two halves of the slit is decomposed by a prism into two spectra, which are in juxtaposition for their entire length, aad one of which only has been modified by absorption. If we then endeavour to equalise these two spectra successively (by modifications of the slit, by polarising apparatus, or otherwise), at a very large number of points corresponding to determined wave-lengths, we obtain the measure of the intensity of the different radiations ab-absorbed. When these intensities are once obtained we may deduce from them directly the coefficients of absorption corresponding to each radiation, and the form of the surface of chromatic absorption in the body which is under examination. If we have some coefficients of absorption of a substance dissolved in known quantity in a medium either non-absorbent, or having an absorbing power feeble and already measured, it is easy to determine the quantity of this same substance in another solution. It is merely requisite to take a stratum of the solution of known depth, and place it before the slit of the analytic photometer, measuring then the intensity of the radiations transmitted to know at once to what depth of the normal solution the same intensities would correspond, and consequently what is the quantity of the absorbent matter contained in the solution to be determined. Spectral analysis thus becomes a true method of quantitative analysis, and its applications are at once greatly extended. It must not be forgotten that this new method of analysis requires that we should be able to study all the radiations emitted or transmitted by different bodies. If we wish to confine ourselves to the study of the visible radiations, the utility of the method would be greatly reduced. But we substitute for the eye another organ, such as, *e.g.*, a thermo-electric battery, immediately substances which appear to absorb nothing in the luminous spectrum may manifest their presence in the ultra-red portion of the spectrum, and the means to determine their quantity is presented. A solution of aluminic sulphate is a case in point, and by the aid of the galvanometer the proportion of the salt contained in different solutions may be determined. The same will happen with the ultra-violet radiations, the intensity of which may be measured by the eye, by the aid of uranium-glass, or of sulphate of quinine. If it is true, as a large number of observations appear to demonstrate sufficiently, that the luminous spectral lines of incandescent gases, or the dark lines which the same gases may determine by absorption in continuous spectra, are merely isolated and more intense summits of spectral curves of emission or absorption, quite similar to the curves of shade which absorbent solids and liquids produce, and if it is true that these lines may multiply and especially increase in breadth and intensity the condensation and the elevation of temperature of the bodies whence they spring, we comprehend that the determination of the luminous intensity at different points of a spectrum may serve to recognise the temperature and the density of the substance which emits or absorbs them, that is to say, to determine its quantity in a limited portion of space, provided that we have beforehand established the relation which connects the nature of the radiations emitted with the density and the temperature of the body under examination. Thus, then, by assimilating the phenomena of the emission- and absorption-spectra of gaseous bodies to those presented by the absorption-spectra of solids and liquids it does not appear impossible that we may succeed in obtaining quantitative analyses of bodies examined, even when such bodies escape ordinary methods of observation by reason of their tenuity or their remoteness. The "photometer-analyser" may still render other services to science. By applying it in the quantitative and qualitative analysis of the colours proper to different bodies we may hope to place the classification of colours upon an absolutely accurate basis.

Certain Properties of Calcium Chloride.—A. Ditte.—If anhydrous calcium chloride is dissolved in the smallest possible quantity of water the temperature rises as the salt dissolves. If the solution, after it has cooled down to its original temperature, is diluted with successive quantities of water, the temperature rises at each addition, and these increases go on diminishing by degrees, becoming *nil* when a very considerable quantity has been added. The author examines these phenomena from a thermo-chemical point of view.

Application of Palladium Wire for the Determination of Hydrocarbides Mixed with Air in Small Proportions.—M. Coquillion.—To determine small quantities of hydrogen or of carbides of hydrogen mixed with air it has been the custom in laboratories to add to these gases a detonating mixture, thus producing an explosion, which effected the total combination of the oxygen of the air with the hydrogen or with the carbides. The author proposes as a substitute for this method to heat a palladium wire to white redness. The smallest traces of hydrogen or of a hydrogen carbide are thus burnt up without the intervention of a detonating mixture.

Influence of the Soil and of Forests upon Climate.—M. Fautrat.—During the activity of vegetation—in June, July, and August—the trees, in drawing nourishment from the air, produce a movement which is shown in the atmosphere by a slight depression of temperature. Above coniferous trees, however, during the day an elevation of temperature is constantly observed, derived from the solar heat which is retained by the vapours enveloping the tops of the trees. It is to this moist and hot medium that the vigorous growth of conifers upon the poorest soils must be ascribed. In a wood there is always an ascending current of air, and outside there is a lateral current from the wood towards the open country. To the ascending current is due the absence of hail-storms in forests.

THE CHEMICAL NEWS.

Vol. XXXVI. No. 946.

LIQUEFACTION OF NITROGEN, HYDROGEN, AND ATMOSPHERIC AIR.

M. Cailletet has communicated to the *Academie des Sciences* some further particulars on the liquefaction of gases, and at the meeting of the 31st of December a paper was read, from which we translate the following:—

"*Nitrogen.*—Pure and dry nitrogen compressed to about 200 atmospheres, at a temperature of +13°, then allowed to expand suddenly, condenses in the most perfect manner; it first produces an appearance like that of a pulverised liquid in small drops of appreciable volume; this liquid then gradually disappears from the sides to the centre of the tube, at last forming a sort of vertical column following the axis of the tube. The duration of these phenomena is about 3 seconds.

"These appearances leave no doubt as to the true character of the phenomena. I first tried the experiment at home at a temperature of —29°, and I repeated it yesterday, the 30th of December, several times at the Laboratory of the Ecole Normale, in the presence of many *savants* and members of the Academy, among whom I am happy to name, with his assent, the venerable M. Boussingault.

"*Hydrogen.*—Hydrogen has always been considered the most incondensable gas, on account of its low density, and the almost complete agreement of its mechanical properties with those of perfect gases. Thus it was only with great doubt as to the result that I decided to submit it to the same tests which had determined the liquefaction of all the other gases.

"In my first attempts I noticed nothing particular, but, as often happens in experimental science, skill in observing phenomena results in causing signs to be recognised under conditions where they had at first escaped notice.

"This is what occurred with hydrogen. On repeating my experiments to-day in the presence of MM. Berthelot, H. Sainte-Claire Deville, and Mascart, who have allowed me to quote their testimony, I have succeeded in observing indications of the liquefaction of hydrogen under conditions of proof which have left no doubt on the minds of the scientific men who witnessed the experiment. It has been repeated a great number of times. Operating with pure hydrogen compressed to about 280 atmospheres, and then suddenly allowed to expand, we saw form an extremely attenuated and subtle mist suspended in the gas and disappearing suddenly. The production of this mist, in spite of its extreme subtlety, seemed incontestable to all the scientific men who witnessed the experiment today, and who took care to have it repeated several times, so as to leave no doubt as to its reality.

"*Air.*—Having liquefied nitrogen and oxygen, the liquefaction of air is thereby demonstrated. It appeared, however, of interest to make this the subject of an actual experiment, and, as might be expected, it succeeded perfectly. I need not say that the air was previously dried and freed from carbonic acid. The accuracy of the views expressed by the founder of modern chemistry, Lavoisier, is thus confirmed as to the possibility of causing air to assume the liquid state, and of producing matter gifted with new and unknown properties—views recalled so appropriately at the last meeting by our illustrious perpetual secretary."

ON THE SULPHATES OF THE VANADIUM TETROXIDE

By Dr. B. W. GERLAND.

1. *Vanadylous Sulphate*, $V_2O_2 2SO_4$.—To the description of this compound, which I gave in the Chemical News (vol. xxxiv., p. 2), I have to add the following:—Prepared by the described method—namely, by rapidly boiling the solution of the tetroxide with a large excess of sulphuric acid—the separated salt, after washing and drying, is obtained in a much more insoluble condition than is stated in the cited paper. When heated with water in a sealed tube 150° for ninety-eight hours, and again for fourteen hours to 170°, only minute quantities enter into solution. But the compound undergoes a change by keeping it at a temperature of about 400° for twelve hours; the colour, which was originally a dirty green, becomes bright green, and in this state it is completely dissolved by a digestion with water in sealed tubes for thirty-six hours at 130°. The solution is perfectly clear, and more or less oily, according to the quantity of water used. It is not decomposed by heating with more water; the slight sediment I had observed before was caused partly by the decomposition of the glass, which was accidentally lead glass, and partly by some impurity in the compound.

The gummy mass left after desiccation of this solution, moistened with water, and left under a glass bell over sulphuric acid, is, in the course of a week or two, converted into crystals, which, according to the following analyses, have the formula $V_2O_2 2SO_4,7H_2O$.

0·2507 grm. yielded 0·1015 grm. V_2O_5, or 40·48 per cent.
0·3723 „ „ 0·1506 „ „ 40·45 „

The average is 40·465 per cent V_2O_5, corresponding t 36·92 V_2O_4.

$V_2O_2,2SO_4,7H_2O$ requires	V_2O_4 ..	36·81
	SO_3 ..	35·35
	H_2O ..	27·84
		100·00

The same analysis was obtained by Crow, by treatment of the acid sulphate with absolute alcohol (*Journ. Chem. Soc.*, 1876, vol. ii., p. 456).

These crystals swell out considerably when exposed to a damp atmosphere, and are gradually converted into a loose mass of small crystals of the composition—

$$V_2O_2 2SO_4,13H_2O.$$

0·2699 grm. of the same gave 0·0879 grm. V_2O_5, corresponding to 29·72 per cent V_2O_4.

The formula $V_2O_2,2SO_4,13H_2O$ requires—

V_2O_4	29·72
SO_3	28·55
H_2O	41·73
	100·00

This salt deliquesces in damp and effloresces in dry air.

The compound $V_2O_2,2SO_4,3H_2O$ is obtained by drying the former salts at 100°. The salt $V_2O_2,2SO_4,7H_2O$ behaved in the following manner:—

0·4986 grm. loss after two hours at 100°, 0·0853, equal to 17·10 per cent.
„ „ loss after five hours more at 100°, 9·1156, equal to 23·18 per cent.
„ „ loss after eight hours more at 100°, 0·1267, equal to 25·41 per cent.
„ „ loss after four hours at 130°, 0·1315, equal to 26·37 per cent.
„ „ leave after calcination 0·1792 grm. V_2O_5, equal to 32·79 V_2O_4.

$V_2O_2,2SO_4,3H_2O,7H_2O$ requires—

		Found.
V_2O_4	32·88	32·79
$2SO_3$	31·58	31·49
$3H_2O$	10·67	10·31
$7H_2O$	24·87	25·41
	100·00	100·00

The compound $V_2O_2,2SO_4,10H_2O$ I have already described (*l. c.*). It was formed in beautiful transparent crystals of 30 m.m. in length, in a larger quantity of the solution which had been standing in the laboratory, loosely covered, for several months. They were too irregular to allow a crystallographical determination.

0·3715 grm. gave 0·1350 grm. V_2O_5, corresponding to 33·15 per cent V_2O_4.

$V_2O_4,2SO_4 10H_2O$ requires—

V_2O_4 .. .. 32·88

Herewith five different compounds of vanadylous sulphate, with water of crystallisation are described, viz.—

$V_2O_2,2SO_4,3H_2O$ (left by drying the following salts at 100°).
$V_2O_2,2SO_4,4H_2O$ (Berzelius).
$V_2O_2,2SO_4,7H_2O$.
$V_2O_2,2SO_4,10H_2O$.
$V_2O_2,2SO_4,13H_2O$.

2. *Acid Vanadylous Sulphate.*—I have described (*l. c.*) a soluble form of the acid vanadylous sulphate obtained from its concentrated solution by precipitation with alcohol, the existence of which has been denied by Crow. This author, following the directions of Berzelius, obtained the neutral vanadylous sulphate by treating the acid salt or its evaporated solution with absolute alcohol. "According to Gerland," he says (*Journ. Chem. Soc.*, 1876, vol. ii., p. 457), "the above method yields a trisulphate, but it appears probable that he did not wash the salt with alcohol sufficiently long to remove all the sulphuric acid." Mr. Crow could not have read my paper, for my method of preparation is essentially different from his, and, bearing in mind Berzelius's reaction of absolute alcohol on the crystals, I stated distinctly that the solution was evaporated "to the consistence of a syrup," and "the separation of solid salt must be avoided;" also that "strong" alcohol was used. I also guarded myself against the reproach of insufficient washing by using the words that the alcohol "still takes up traces of sulphuric acid."

According to Berzelius the decomposition does not take place instantaneously; the crystals of the acid sulphate had to be washed repeatedly with absolute alcohol, and then left in contact with fresh quantities of the same for some time before the swelling of the mass set in. Mr. Crow must have experienced the same behaviour, or else he would not have stated (*l. c.*, 456) "they (viz., the trisulphates) are scarcely soluble in absolute alcohol." The difference of the results is readily explained by taking into account the proportions of real alcohol, acid sulphate, and water.

A solution of vanadium tetroxide, heated with an excess of sulphuric acid to about 120° for several hours, deposits crusts of hard, transparent, blue crystals. These are highly hygroscopic, and are rapidly dissolved by water, alcohol, or ether, under separation of a small quantity of light blue shiny scales. The crystalline crusts were drained on porous tiles, under a bell glass dipping into sulphuric acid, and submitted to analysis. Three different preparations yielded the following results:—

(1.) 0·5324 grm. substance gave $PbSO_4$ 1·0729.
V_2O_5 0·1847
(2.) 0·7565 ,, ,, ,, 1·5443
V_2O_5 0·2532
0·836 ,, ,, H_2O 0·1335

	(1.)	(2.)
V_2O_4..	31·65 per ct., 1·00 mol.	30·53 per ct., 1·00 mol.
SO_3 ..	53·20 ,, 3·50 ,,	53·89 ,, 3·67 ,,
H_2O ..	15·15 ,, 4·43 ,,	15·95 ,, 4·83 ,,
	100·00	100·37

These figures point to a composition corresponding to the formula $V_2O_2,H_2,3SO_4,3H_2O$.

The scales, which separate from these crystalline crusts on treatment with cold water, were separated from the solution on the vacuum filter, washed successively with dilute and strong alcohol and with ether, and dried over sulphuric acid. They have a beautiful pale blue colour, with strong lustre, and appear under the microscope as square plates, which, according to their behaviour under polarised light, possess no optical axis, and are therefore cubes. (I have to thank my friend Dr. F. Hurter for this and other crystallographical observations.) The compound dissolves very slowly in cold water, but rapidly in hot water, and requires one or two days' exposure to the air to deliquesce. According to the following analysis its composition is represented by the formula—

$V_2O_2,H_2,3SO_4,2H_2O$,

and is consequently distinguished from the crusts by a minus of H_2O:—

The scales dried over sulphuric acid lost, at 130°, 0·8 per cent.

(1.) 0·6870 grm. substance gave $PbSO_4$ 1·3486
V_2O_5 0·2728
1·0728 ,, ,, H_2O 0·1365
(2.) 0·7730 ,, ,, loss at 160° 0·0537 = 6·94 pr. cent H_2O
0·6229 ,, ,, $PbSO_4$ 1·2133
(3.) 0·3278 ,, ,, V_2O_5 0·1280
0·5066 ,, ,, $PbSO_4$ 0·9877

	Found. (1.)	(2.)	(3.)	Calculated for $V_2O_2,H_2,3SO_4,2H_2O$
V_2O_4..	36·23	—	35·62	36·18
SO_3 ..	51·83	51·42	51·47	52·10
H_2O ..	12·72	—	—	11·72
	100·78			100·00

The same compound is obtained in larger quantity by heating the solution of vanadate oxide, in a large excess of sulphuric acid, to a higher temperature, 140° to 160°, far a longer time. (It is most probable that the scales are ready formed enclosed in the crystalline crust, and not formed by their treatment with water.) Scales thus prepared and treated as above have, according to the following analysis, the same composition:—

0·9710 grm. substance gave, Insoluble—
($V_2O_2,H_2,4SO_4,2H_2O$) 0·0073
$PbSO_4$ 1·8923
0·6424 ,, ,, V_2O_5 0·2543

Calculated: V_2O_4 .. .. 35·65 per cent.
SO_3 .. .. 57·45 ,,
Insoluble .. 0·75 ,,

This acid vanadylous sulphate formed in solutions, which contain potassium, calcium, iron, and probably other metals, encloses such metals, and these cannot be separated by solvents. This peculiarity I have already mentioned of the ammonium vanadate, and it appears to be common to many other vanadium compounds. The small quantity of potassium, calcium, or iron present in the solution facilitates the formation of the scales, increases their quantity, and causes them to be perceptibly less soluble in water. For the preparations of the compound whose analyses are here given the ammonium vanadates were used, prepared by precipitation of potassium vanadate with chloride of ammonium, and containing about 2 per cent H_2O.

(1.) 1·0219 grms. of substance gave—

$PbSO_4$	2·0288	V_2O_5	0·4025
K_2SO_4	0·0184	$CaSO_4$	0·0065

(2.) 0·8046 grm. of substance gave—

$PbSO_4$	1·1757	V_2O_5	0·3060
K_2SO_4	0·0262		

Calculated :—

	(1.)	(2.)
V_2O_4	35·93	34·69
SO_3	52·41	50·17
CaO	0·26	—
K_2O	0·97	1·76

3. *Double Salts of the Vanadylous Sulphate.*—As it was of interest to produce double salts of the vanadylous sulphate in order to characterise the last-described compound as an acid salt, I have extended the experiments described in my former paper (*l. c.*)

The solutions of V_2O_2, H_2, $3SO_4$, $3H_2O$, and K_2SO_4, in the proportion of their molecular weight, were mixed with a large excess of sulphuric acid, and kept for several hours—for No. 1 at 180° to 200°, for No. 2 at 120°. The acid was poured off after cooling, and the small scales purified by washing with cold water, alcohol, and ether, pressing between filter-paper, and drying over sulphuric acid. The salt is like the above-described acid sulphate, only the scales appear rather larger, of paler colour, and are less quickly soluble in water.

(1.) 1·0035 grms. substance yielded—
$PbSO_4$ 1·7917 V_2O_5 0·3596 K_2SO_4 0·0870

(2.) 0·6448 grm. substance yielded—
$PbSO_4$ 1·1117 V_2O_5 0·2318 K_2SO_4 0·1203

Calculated :—

	(1.)		(2.)	
V_2O_4 ..	32·69 p. ct.,	1·00 mol.	32·79 p. ct.,	1·00 mol.
SO_3 ..	47·13 ,,	3·00 ,,	45·51 ,,	2·89 ,,
K_2O ..	4·69 ,,	0·25 ,,	10·08 ,,	0·54 ,,
Diff. (H_2O)	15·49 ,,	4·11 ,,	11·62 ,,	3·28 ,,
	100·00		100·00	

The salts V_2O_2, H_2, $3SO_4$, $3H_2O$, and K_2SO_4 were dissolved in water, in proportion of their molecular weights : this solution dries in air to a pale blue amorphous mass, which was pressed and washed with dilute alcohol. The solution of this salt dries to a pale blue, transparent, gummy mass, without any trace of crystals: this was ground, washed with small quantities of cold water, and dried over sulphuric acid. The same preparation was, with slight alterations, repeated. The analyses of two gave the following results :—

(1.) 0·6290 grm. substance gave—
$BaSO_4$ 0·8397 V_2O_5 0·1629 K_2SO_4 0·2695
(This analysis appeared, *l. c.*, page 2, with a mistake.)

(2.) The hot concentrated solutions of the salts, mixed, separated on cooling small crystals : these were collected, pressed, washed with a little cold water and dilute alcohol, and again dissolved in water ; after evaporation in the cold a blue gummy substance was left, similar to No. 1.

0·5016 grm. substance gave—
$PbSO_4$ 0·7951 V_2O_5 0·1151 K_2SO_4 0·2162

(3.) 1 mol. V_2O_2,H_2,$3SO_4$,$3H_2O$ and 2 mols. KCl, dissolved in hot water, were precipitated with alcohol. The precipitate was pressed and washed ; its solution in water dried to a blue soft mass, of the consistency of honey, which was found to be free from chlorine.

1·0906 grm. substance gave—
$PbSO_4$ 1·5708 V_2O_5 0·2415 K_2SO_4 0·2366

(4.) A concentrated solution of 1 mol. V_2O_2,$2SO_4$ was mixed with a hot concentrated solution of 1 mol. K_2SO_4, and precipitated with alcohol. The precipitate was, after washing with dilute alcohol, pressing, and drying over sulphuric acid, submitted to analysis.

1·0212 grms. substance gave—
$BaSO_4$ 1·1940 V_2O_5 0·2574 K_2SO_4 0·3135

Calculated for—

	(1.)		(2.)	
V_2O_4 ..	23·59 p. ct.,	1·00 mol.	20·93 pr ct.,	1·00 mol.
SO_3 ..	45·83 ,,	4·04 ,,	41·85 ,,	4·16 ,,
K_2O ..	23·18 ,,	2·09 ,,	23·40 ,,	1·97 ,,
Diff. (H_2O)	7·40 ,,	2·86 ,,	13·82 ,,	6·11 ,,
	100·00		100·00	

	(3.)		(4.)	
V_2O_4 ..	20·20 p. ct.,	1·00 mol.	23·00 p. ct.,	1·00 mol.
SO_3 ..	38·03 ,,	3·91 ,,	40·14 ,,	3·64 ,,
K_2O ..	11·73 ,,	1·02 ,,	16·60 ,,	1·28 ,,
Diff. (H_2O)	30·04 ,,	—	20·26 ,,	8·15 ,,
	100·00		100·00	

These figures show that in no case was a pure substance obtained; still they prove unmistakably that the potassium enters into combination as substitute for hydrogen : however, it appears that a neutral salt is only reached when K_2SO_4 have entered, besides the K_2 replacing hydrogen.

I have not succeeded in obtaining the corresponding compounds with magnesium or sodium. The solutions of the acid, or neutral vanadylous sulphate, mixed with sodium or magnesium sulphate, deposit these latter salts on evaporation in their ordinary crystals.

Dialysis decomposes the vanadylous potassium sulphate rapidly ; the vanadylous sulphate penetrates the membrane more rapidly than potassium sulphate. Equal molecules of V_2O_2, $2SO_4$, and K_2SO_4 were dissolved in water, and brought upon the parchment paper. The level in the dialyser rose rapidly 14 m.m., and the outer water had become strongly tinged. The analysis of the latter gave the following results :—

$PbSO_4$ 1·6591 V_2O_5 0·4200 K_2SO_4 0·1232

Calculated :—

V_2O_4	0·3832 grm.,	1·00 mol.
SO_3	0·4378 ,,	2·38 ,,
K_2O	0·0666 ,,	0·31 ,,

4. *Dialysis of the Acid Vanadylous Sulphate.*—The following analyses show that the salt dialysis causes decomposition of the compound V_2O_2,H_2,$3SO_4$ into H_2SO_4 and V_2O_2,$2SO_4$, the former traversing the membrane more rapidly than the latter.

(1.) 1 grm. V_2O_2,H_2,$3SO_4$,$3K_2O$ dissolved in 7 c.c. water filled into the dialyser which floated on 15 c.c. water.

Solution from the dialyser gave—
$BaSO_4$ 0·3984 grm. = SO_3 0·1367 grm., 2·64 mol.
V_2O_5 0·1180 ,, = V_2O_4 0·1078 ,, 1·00 ,,

Exterior water gave—
$BaSO_4$ 0·5412 grm. = SO_3 0·1858 grm., 3·28 mol.
V_2O_5 0·1293 ,, = V_2O_4 0·1179 ,, 1·00 ,,

(2.) 2 grms. V_2O_2,H_2,$3SO_4$,$3H_2O$ dissolved in 10 c.c water were dialysed into 20 c.c. water.

The first water gave V_2O_4 = 9 c.c. permanganate solution (1 c.c. permanganate = 0·003301 grm. oxygen), equal V_2O_4 0·3094 grm., 1 mol.

$BaSO_4$ 1·4234 grms. = SO_3 0·4888 grm., 3·29 mols.

The second water gave V_2O_4 = 6 c.c. permanganate.

V_2O_5 0·1439 grm. = V_2O_4 0·1312 grm., 1·00 mol.
$BaSO_4$ 0·6161 ,, = SO_3 0·2115 ,, 3·35 ,,

The solution which remained in the dialyser gave—

V_2O_4 = 6 c.c. permanganate solution.
V_2O_4 0·2062 grm., 1·00 mol.
$BaSO_4$ 0·7542 grm. = SO_4 0·2589 ,, 2·61 ,,

Macclesfield, November, 1877.

APPLICATION OF ORGANIC ACIDS TO THE EXAMINATION OF MINERALS.

By H. CARRINGTON BOLTON.

(Continued from p. 250).

IV. SUNDRIES.

Mineral.	Formula.	Description.	Locality.
Apatite	$\dot{\dot{C}}a^3\dot{\dot{:}}P+\frac{1}{3}Ca(ClFl)$	crystals	Mitchell Co., N.C.
Vivianite	$\dot{\dot{F}}e^3\dot{\dot{:}}P+8\dot{H}$	radiated, fibrous	Mullica Hill, N. J.
Pyromorphite	$3Pb^3\dot{\dot{:}}P+PbCl$	crystalline	Bohemia.
Fluorite	$CaFl$	translucent, massive ..	Muscalonge Lake, N. Y.
Cryolite	$3NaFl+Al_2Fl_3$	massive	Greenland.
Anglesite	$\dot{P}b\dot{\dot{:}}\dot{S}$	.....	Phœnixville, Pa.
Gypsum	$\dot{C}a\dot{\dot{:}}\dot{S}+2\dot{H}$	crystals	Montmartre, France.
Samarskite.....	$(R^3RR^3_2)_5Cb_3$	massive	Yancey Co., N. C.
Silver	Ag	pure silver	?
Copper	Cu	copper foil	?
Iron.....	Fe	iron wire.....	?
Zinc	Zn	granulated	Bethlehem, Pa.
Lead	Pb	test-lead	?
Tin	Sn	granulated	?
Aluminium.....	Al	foil	France.
Antimony	Sb	massive, crystalline	?
Bismuth	Bi	massive, crystalline	?

(To be continued).

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, November 27, 1877.

Dr. R. Angus Smith, F.R.S., Vice-President, in the Chair.

"*On the Construction of a Room or Series of Rooms free from Germ Life, proposed for use in the performance of Surgical Operations*," illustrated by a Model Room and Apparatus, by William Thomson, F.R.S.E.

My object in bringing this paper before the Society is to show what I consider to be a valuable application of a well-known principle, viz., that of filtering from the ordinary air the innumerable spores which are constantly found floating about in it, and so to arrange a room or series of rooms, in which the air may be rendered optically pure. The practicability of producing, and afterwards retaining in a room or rooms of ordinary dimensions, an optically pure atmosphere, were suggested to me by the results of a large number of experiments which I have carried on during the last seven or eight years, but more especially the results obtained from a series of experiments which I commenced about the beginning of this year, on the cultivation of different fungi, the spores of most of which are found in large numbers, floating about in our atmosphere.

Flour paste suggested itself as the best soil I could obtain on which to grow the different fungi. When flour paste is exposed to the air for a few days, as is well known, fungus makes its appearance, and soon completely covers its surface, and if a number of flour pastes be made and exposed in different places, it will be found that different kinds of fungus spring up, in each showing a splendid variety of different colours, and shades of the same colour. It was with a view to isolate and study these different fungi that one of my last series of experiments was commenced, and it became necessary to look for a means of sowing the seeds of each fungus on a soil which should originally be free from spore life, and afterwards should be effectually protected from the falling of other spores from the air on to the soil, and further, should, if possible, give a free and open supply of air to the microscopic plants.

After a few experiments I found that this could be done effectually by placing flour paste in an ordinary glass shade turned upside down, covering the mouth of the shade with a thin layer of cotton-wool placed between two pieces of cloth, the three layers being fixed round the edges of the glass by an elastic band. The paste, when boiled in the vessel thus closed, was afterwards found to remain free from fungus life for any length of time. Having thus been successful by such a rough arrangement in preventing the entrance of fungus spores, I next arranged to try the same experiment on a rougher and larger scale, and consequently had the rough model made which I show here this evening. Each side of this box or room is

made of thin layers of cotton-wool sewn between two two pieces of cloth, with a glass in front, which serves equally as door and window. A conical-shaped piece made of stout paper is pasted to a square frame at its base, which fits against one end of the room. An ordinary glass funnel is placed in this cone, with its stem passing through the apex, which is firmly tied round it, and an india-rubber tube communicating with a pair of bellows is put on the end of the stem; the large end of the funnel is covered with a thin layer of cotton-wool placed between two pieces of cloth, and the whole fixed round the funnel edge by means of an elastic band. When the window at the other end of the room is opened and the bellows worked, a current of air passes through a layer of cotton-wool placed between two pieces of cloth on the mouth of the funnel and then through that at the end of the room, moves bodily along the room and escapes at the window, little or no special currents or draughts being apparently produced. This I observed by previously filling the room with fumes. The force of the air, by passing through the two layers of cotton-wool, was evidently equally distributed throughout the whole area of the room. My first experiment with this arrangement was made by simply working the bellows for about twenty minutes to endeavour to drive the impure air, with its floating particles and spores, out of the room by passing into it the filtered air from the bellows; then boiling one-half of some flour paste in a basin inside the room for a minute or two, and lastly, closing the window with the glass, the other half of the paste being boiled in a similar basin and left outside exposed to the ordinary or contaminated air. After a few days the difference between the two pastes was very marked, the surface of the one left outside the room was completely covered with fungus, whereas, only four or five little specks of fungus were observed to be growing on the surface of the one inside the house, which soon developed into 4 or 5 little buttons of fungus. I considered that the spores which had fallen on this flour paste must have been sticking to the sides or roof of the room, and to eliminate this assumed cause of error, I drew out the supporting rods of the room and crushed it up and boiled it in water for half an hour, then allowed it to dry and repeated the same experiments with the two basins of flour paste, the bellows being first worked and the glass then taken out and laid down in the ordinary or contaminated air, then wiped with a clean cloth and put in. In a few days afterwards, the paste outside the house was completely covered with fungus, whilst the one outside was absolutely free from it, and it remained free for nearly a month, when one little speck was observed on it which soon developed into a little button of fungus. This showed that for three weeks after the paste was placed in the room no spore had fallen on it, The only cause of failure I could see was the glass, upon which some spores must have adhered, consequently I had a bag made and sewn on above the window, into which the glass could be pulled in opening the window. When this was done the house was again crushed up and boiled in water, again placed in position, the paste boiled, the window closed, and in this third trial the experiment was perfect. No fungus was developed on the paste inside the house, and after some months it dried up to a hard mass. Thus these thin sheets of cotton-wool forming a room of 10,032 cubic inches capacity, *i.e.*, capable of holding 36 gallons of air, was sufficient to prevent the entrance of spores into it, and thus to preserve the flour paste from decomposition during several months, till it had completely dried up.

These results, I think, conclusively show that ordinary large rooms may be constructed and ventilated with filtered air, by means of fans, so that flour paste, taken as a test standard, would remain in them free from fungus life, and I believe that such a room or series of rooms might be of great advantage in surgery, perhaps as a means of preventing spores from entering the wounds of patients, and so doing away with or lessening the onus put upon the antiseptic treatment, or in giving a better chance of success in serious surgical operations. It is, I understand, believed by many medical men that pus and blood poisoning may be generated in a wound, from the blood corpuscles or bioplasts in the body, and that such developments have nothing to do with the germs of the outside air, and that the antiseptic treatment is employed to assist their development, but no one, so far as I know, has ever proved this beyond doubt, and such an arrangement of a room or rooms as I shall suggest further on would, I believe, be one mode of experimenting, whereby the whole or a great part of a serious obstacle to such researches may be eliminated; but in passing, I should like to mention one slight incident in reference to the development of pus in wounds which would tend to show that certain germs floating in the air are capable either directly or indirectly of developing pus. Some years ago, when working with a solution of albumen, which had been exposed to the air for some time, and which was then putrid, and swarming with bacteriæ, I accidently cut my finger, and some of the putrid liquid entered the wound. I washed it out as well as possible, and thought nothing of it. Next morning it was slightly swollen, and had gathered. I opened it with a knife, and microscopically examined the matter, expecting to find bacteriæ, but to my surprise no bacteriæ could be observed, and all that could be seen was simply pus cells.

The arrangements which I should suggest on the large scale are, a long room or series of rooms in a line, at one end of which should be fitted a fan behind a good filter of cotton-wool, a long pipe with a series of Bunsen burners set along it, so that when all were lit a line or sheet of flame would be produced which might be gently passed along and made to play on every part of the floor, walls, and roof of the room, beginning near the end at which the fan works and going gradually towards the door; by this means any spores adhering to the walls would be destroyed, and no air could pass back to pollute the walls or floor which had been thus purified. A stove might be arranged at the door end of the room, by which cotton garments to cover the ordinary clothes of the surgeons and attendants might be heated to a temperature presumably sufficient to destroy or paralyse the vitality of any spores which might have been adhering to them, and where the knives and other appliances used might be previously heated, and where water used in washing the wounds might be previously heated under pressure. With such an arrangement at an hospital it seems to me that one interesting mode of investigation into some most important subjects might be commenced.

PHILOSOPHICAL SOCIETY OF GLASGOW.

Chemical Section.

December 10, 1877.

Professor John Ferguson, M.A., President, in the Chair.

At the annual business meeting of the Section, which was held this evening, the Treasurer's and Auditors' reports were submitted and approved of. From the former it was shown that there were 45 associates of the section, in addition to the ordinary members of the Philosophical Society. The vacancies in the Council were filled up by the election of Messrs. James Mactear, Alexander Whitelaw, Edw. C. C. Stanford, F.C.S., and Robert R. Tatlock, F.R.S.E. At the Council meeting, subsequently held, Messrs. Tatlock and Stanford were elected vice-Presidents of the Section; Mr. J. J. Coleman, F.C.S., was re-elected Treasurer; and Mr. John Mayer, F.C.S., was re-elected Secretary.

Two new associates were elected into the Section—namely, Mr. John S. MacArthur, Tharsis Company's Laboratory, Glasgow; and Mr. Alexander S. Maclean, Baker Street, Greenock.

Mr. James Mactear, of St. Rollox Chemical Works, then read a paper on "*An Improved System of Alkali Manufacture.*" He said that what was usually called the "Alkali Manufacture" was in reality a group of chemical processes, constituting by far the most important of all the great chemical industries of the day. Although in outline the process was well described in most text-books, it would not be out of place to give a short sketch of the general scope of the manufacture, leaving out of consideration altogether the so-called ammonia process, which, although at work in two establishments in England, could never be more than a mere fraction of the whole manufacture, unless under most extraordinary conditions as regards ammonia and common salt.

The group of processes together forming the alkali manufacture must be thus stated:—

1. Production of sulphuric acid.
2. Decomposition of common salt by the sulphuric acid, with the production of sulphate of soda and hydrochloric acid.
3. The utilisation of the hydrochloric acid, either for the manufacture of bleaching powder, chlorate of potash, bicarbonate of soda, or sulphur (recovered from the waste produced in the final process of the alkali manufacture).
4. The conversion of the sulphate of soda, by its decomposition with carbon and carbonate of lime, into carbonate of soda and sulphide of calcium, and the subsequent separation of these two compounds by lixiviation with water.

We were indebted, he said, to the genius and skill of Leblanc and his associate Dizé for that combination of processes; and, except in the improved construction of the apparatus, until very recently, the process remained identical with that used by Leblanc and his followers during a period of over three-quarters of a century, notwithstanding the constant researches of chemists and manufacturers. He did not intend to enlarge upon the improvements in the stages of the manufacturing of sulphate of soda and condensation of hydrochloric acid, as well as those of sulphuric acid and bleaching-powder, but proposed to confine himself to the production of alkali from sulphate of soda.

The character of the decomposition which took place had been studied by many of the most celebrated chemists, amongst whom Liebig gave a considerable amount of attention to the subject and invented a process for the production of alkali, which was not generally known; it was based on the decomposition of woody fibre, in the form of sawdust, by sulphide of sodium, and he thought so highly of it that he took steps to protect it both in this country and in France by a patent. However, whilst very beautiful as a theoretical process, it failed completely on a manufacturing scale.

The theory that an excess of lime was absolutely necessary to the formation of an insoluble compound of calcium and sulphur was a favourite one for many years, and appeared in many forms, the variations in the formulæ depending, as might easily be seen, on the proportions of carbonate of lime used in the decomposition. This theory was dissipated by Gossage and others, but yet it was always found necessary to use an excess of limestone over that which their explanation showed to be necessary, and in practice there was commonly used a mixture of—

Sulphate (commercial)	100
Limestone	108
Coal	50 to 60

The only change of any magnitude that had been introduced up to the year 1873 was the system proposed by Messrs. Stephenson and Williamson, of the Jarrow Chemical Works, who, having adopted the improved form of furnace (subsequently to be described), patented the method of heating the limestone and a portion of the coal for some time, so as to produce a small proportion of caustic lime, after which the sulphate of soda and the remainder of the coal was added, and the decomposition then finished as usual. The introduction of the furnace originally invented by Messrs. Elliott and Russell, which was a cylinder of iron lined with brick, and made to revolve on bearing wheels, was a great advance, but the furnaces being of small size and defective construction at first, did not succeed as was expected. From time to time this class of furnace had been improved, however; and from the small one originally erected, which worked some 10 tons per day, there were now furnaces of a modified form, which the author designed in 1873, working 50 tons per day with ease. That great increase of power had not, however, been attained altogether by the altered construction of the furnace, but to the extent of at least one-third by the adoption of the improved system of manufacture which he had introduced, and which he proceeded to describe.

Having studied carefully the various theories of the decomposition taking place in the production of alkali, he became clearly of opinion that the use of more than an equivalent of carbonate of lime was perfectly unnecessary, in so far as the decomposition of the sulphate was concerned. All attempts to produce alkali to advantage on that basis were quite unsuccessful, owing to the great insolubility of the black-ash thus produced.

He satisfied himself, however, that the decomposition was quite perfect, and he had thus reduced the problem to that of the lixiviation. It occurred to him that, if by any simple means the black-ash could be broken up while exposed to the water used in the lixiviation, the difficulty of the insolubility of the black-ash would be got over; and having established the fact that the insolubility of the black-ash seemed to depend very much on the amount of caustic soda existing in the liquors, and that again on the excess of limestone used, he came to the conclusion that if caustic lime in pieces were distributed through the mass of black-ash, that, in slaking, would rend the balls in pieces, and allow the lixiviation to proceed satisfactorily. Having tried this on the large scale, he found it to succeed perfectly, and the improved process as now worked was based on that principle.

It is conducted thus:—The sulphate of soda, with a quantity of carbonate of lime equal to as nearly as possible one equivalent, and a proportion of coal which varies a little with the quality in various districts, is placed in the furnace, which is made to revolve rather slowly at first; the usual melting and decomposition of the sulphate takes place, and when all the sulphate has been decomposed, which is known by various signs, the furnace is stopped and a quantity of caustic lime, in small pieces, is dropped in; the furnace is then set agoing again, and the lime rapidly mixed through the charge, which is then withdrawn as rapidly as possible. It is sometimes necessary to add with the lime some coal, or even cinders, in order to keep the ball as porous as possible. This depends very much on the quality of the coal, which ought to be of such a nature as to leave a considerable quantity of carbonaceous matter in the waste; this, in the ordinary system of working, usually amounts to about 10 per cent on the waste, which equals about 20 per cent on the coal used in the mixture.

The advantages of this very simply conducted process are very great.

First.—By its use the output of the furnaces has been increased from 50 to 70 per cent.

Secondly.—There is a large saving in limestone and coal.

Thirdly.—There is a much reduced quantity of waste.

Fourthly.—There is a considerably increased yield of alkali from a given quantity of sulphate of soda.

(1.) As regards the increased output from a given furnace, this not only gives greater productive power to the plant, but results in a considerable saving of wages; for as the weight of total material per ton of sulphate of soda used is reduced by some 20

per cent, it naturally follows that the weight handled is less, and so also are the costs of labour.

(2.) The limestone in excess in the ordinary process of Leblanc as usually worked gives considerable infusibility to the mass, and necessitates greater consumption of coal for its fusion; whereas, in the author's system, the quantity is reduced as low as possible, and the fusibility of the mixture being much increased there results a considerable saving in fuel.

(3.) The reduction in the quantity of waste (about 30 per cent.) is of advantage in various ways.

(*a*.) The quantity being less, and the percentage of alkali left after lixiviation being no more than on the old system, there is of course a gain of alkali, estimated at about 1½ per cent.

(*b*.) The cost of removal of the waste and its deposit is the source of a considerable expense to manufacturers, and is of course exactly in proportion to the weight produced; so that, if there is 30 per cent. less waste produced, there ought to be 30 per cent. of the cost of removal saved.

(*c*.) As it is almost certain that the production of sulphur from alkali waste will before long form one of the regular processes of an alkali works, owing to the necessity of condensing and utilising all the muriatic acid, for which there is at present only, it may be said, an outlet in the manufacture of bleaching-powder, it is clearly of great advantage to have the waste in a form in which there is as little as possible of useless material, such as carbonate of lime, and which may therefore be the more easily dealt with in the way of oxidation, &c.

4. The reduced quantity of waste also gives, as above, an increase in yield of alkali; but there is also the fact that better decomposition of the sulphate of soda is obtained, as might be expected, from the greater fusibility, and therefore liquidity, of the molten mass, which renders the agitation and mixture more complete.

This process has now been in use for some years at the works of the author's firm (Messrs. Charles Tennant & Co.), and has also been adopted with marked benefit by various large manufacturers both in this country and in France. The amount of saving stated in money varies with the costs of raw material and labour, but may be said to range from five shillings to ten shillings per ton of soda-ash, calculated as containing 48 per cent. of alkali.

In the course of a discussion which followed the reading of the paper,

Mr. Tatlock referred to the ammonia process, and asked why it had not, or might not, become a commercial success.

Mr. Mactear, in reply, said that there were three points which required to be considered in connection with the process, one or more of which must be fulfilled in order that it might be rendered successful. First, there must be cheap ammonia; secondly, there must be cheap salt; thirdly, there must be cheap limestone. Now, the only two alkali works in which it had been adopted in this country were in or near the salt district of Cheshire; and the Belgian works in which it was in operation were situated in a limestone quarry.

Dr. William Ramsay briefly remarked upon the Hargreaves process, and asked for some information about it.

Mr. Mayer said that he had lately been one of a small party who visited some of the chemical works upon the Tyne, including the great establishment of Messrs. Stevenson & Co., over which they had been conducted by the senior partner, and at which the process referred to was in operation. Mr. Stevenson had taken special delight in showing them the very extensive and complete arrangements for successfully carrying out the process, and with it he expressed the utmost confidence. There had been difficulties with it, but he was satisfied that practically they had been overcome, and would in time be entirely overcome.

Mr. Mactear stated that the Hargreaves process had already cost Messrs. Stevenson & Co. a sum of £30,000, and that it would probably cost even more; but he felt that the firm would not be likely to give in until they had made it a complete success. He hoped that it would succeed, for it was really a beautiful process. The turning point in reference to it was the question of the economy of fuel, and there was certainly a great saving of fuel effected by the process. Theoretically, there should not be more than 7½ cwts. of coal consumed per ton of sulphate of soda made. In the ordinary process the consumption of coal was 12½ cwts., and in practice he believed it had been reduced to 10 cwts. in the Hargreaves process.

Mr. Stanford, who had seen that process in operation in company with the inventor himself, considered that it could only be made a perfect success by carrying out improvements in the direction of substituting machinery for hand labour.

A vote of thanks to the author of the paper concluded the proceedings.

NOTICES OF BOOKS.

Elements of Agricultural Chemistry and Geology. By the late Prof. J. F. W. Johnston, of Durham, and C. A. Cameron, M.D. Tenth Edition. Edinburgh and London: W. Blackwood and Sons.

The value of Prof. Johnston's work has long ago passed out of the regions of possible doubt, and the fact that ten successive editions have now been called for proves how widely and generally its merits have been recognised. In the present issue the editor, Dr. Cameron, has incorporated with the work the recent advances made in the applications of chemistry and physics to agriculture. In addition to novel facts he has also deemed it advisable to bring forward modern theories and modern nomenclature, the use of which seems more strongly insisted upon in England than in any other European country. Whether in so doing he has acted judiciously is in our humble opinion an open question. We fear that long before the "new nomenclature" has penetrated into the farm and the workshop, it will, in turn, have become "old," and that such tables as that on page 14 will have to be increased from three to four columns, to the ever-growing perplexity of the reader. Concerning this same table we may venture to point out that its accuracy is not unimpeachable. "Soda-ash," and not "washing-soda," is the popular name of "disodic carbonate"—a compound to which Dr. Cameron ascribes the remarkable formula K_2CO_3. "Washing-soda" is generally understood to mean the crystalline salt with 10 equivalents of water. Again "salt-cake" and "Glauber's salts" are not commonly understood to be synonyms, the former being the anhydrous and the latter the crystalline salt. "Hydric calcic oxide" is popularly known as "slaked lime," not as milk of lime, which latter is the name of a mechanical mixture of slaked lime with a variable excess of water. That "salenixum" was a name applied in the middle ages to the bisulphate of soda we are fully aware. But if Dr. Cameron were to go into any dye-works in modern England and ask to see some salenixum, he would assuredly be shown some Glauber's salt. The fact is that popular names, though less subject to change than those involving a theory,—and therefore, in so far, preferable—are not absolutely immutable. We regret having to point out these errors, but it will be at once conceded

that the slightest mistake in what should be an explanatory table, may be of serious consequence to the reader.

The components of the atmosphere we find divided into three groups, headed respectively: *certainly* essential, *probably* essential, and *possibly* essential. The members of the last category are not merely nitric acid, but carbonic oxide, carbonetted hydrogen, sulphuretted hydrogen, and organic matter. On what grounds the four ingredients last mentioned are supposed to be "possibly essential" we are at a loss to conceive. We should be inclined to class them as "probably injurious."

Concerning the effects of different soils upon the quality of the crops—a point which has scarcely met with the attention it deserves—we find the following interesting statement:—"It is a remarkable circumstance that on the London Corn Exchange the dealers seldom buy British peas without first sending a sample to be boiled; whilst foreign peas are generally bought without any trial. They are almost invariably boilers. For split peas, used in making soups and pease-meal, it is obvious that this boiling property is of great importance." The author remarks that "lime and gypsum are said by some to impart the boiling quality, whilst by others exactly the reverse is stated." Now, in connection with this circumstance, we may take the fact that field peas, used when green, are never so sweet and soft as garden peas. The reason we have always heard suggested is that the former grow in soils manured more or less with superphosphate, which is scarcely ever employed in gardens. Now, all superphosphate contains gypsum. If we take water holding sulphate of lime in solution we shall find that vegetables will not boil soft in it, and it seems very probable that the same effect is produced if the sulphate of lime is present not in the water, but in the vegetable. This view harmonises with the superior boiling properties of foreign peas. Abroad, superphosphate has not yet been used as extensively as in England, and the arable soils are therefore less saturated with gypsum. We have heard, also, that English peas have altered for the worse within the memory of persons still living. Several other instances of the influence of soil upon crops are given, presenting a series of most important, but as yet unsolved, problems in agricultural chemistry.

The power of burnt clay to absorb and preserve the droppings of sheep, at once suppressing nuisance and economising the fertilising ingredients, is fully acknowledged. It is strange, however, that sanitary authorities, after reading such evidence, can still deny the value of similar absorbents as applied to human excreta.

In speaking of irrigation the author omits to show—as he might very usefully have done—why irrigation is less prevalent in Britain than in many other countries, and why, if attempted, it could not be so beneficial. The reason is simply this, that there is perhaps no civilised and cultivated country where the rain-fall bears so high a proportion to the average evaporation as in the British islands, and where drought is so uncommon.

It is remarked that "about 7 lbs. of combined nitrogen from rain, snow, and dew are obtained by each acre every year." But is not the nitrogen found in snow simply what has been given off from the soil upon which it has been lying, whilst such as has been collected from a flagged or asphalted court is practically free from nitrogen? As regards the great question whether the free nitrogen of the air is capable of being assimilated by plants or not the author and editor give judgment in the negative. In view, however, of the present researches of Berthelot we can scarcely think the matter decided.

The presence of copper in the ash of plants is stated to be in all probability merely accidental—a proposition which we can scarcely accept when we remember with what regularity it is found, not merely in manufactured cocoas and chocolates, but also in samples of the raw cacao-bean from different localities.

Viewing the book in its present form as a whole, it may safely be pronounced, not merely a treasury of useful information, but a medium for the inculcation of sound and, in the highest sense practical, principles. It would be a happy day, not merely for the agricultural interest, but for England in general, if farming were generally carried on in the light of the laws laid down in these pages.

CORRESPONDENCE.

THE INSTITUTE OF CHEMISTRY.

To the Editor of the Chemical News.

Sir,—Chemists will not be surprised that I, who do not belong to the Royal Society, nor to the Chemical Society nor even to the Society of Public Analysts, should have declined to join the Institute.

Sympathy with rising English chemists and interest in our science prompts me to publish some of the reasons against the Institute.

In the first place, as every one who has read Mr. Groves's circular will perceive, the formation of the Institute implies the taxation of English chemists at the rate of four guineas a head; and when it is borne in mind that chemical research is almost necessarily unremunerative to the actual worker, and how heavily the resources of chemists are drawn upon by the Chemical and other societies and associations, the proposal still further to tax the English chemist becomes a serious matter. And my object in writing this letter is to give warning that repayment by the benefits arising from the Institute is not to be looked for.

Those chemists who live by analytical work will be aware that the great grievance is not so much that persons utterly ignorant of chemical analysis (persons whom the Institute might possibly exclude) defraud the public and themselves by performing incorrect analysis, but that so much of the work done by presumably competent persons is bad.

For this grievance the Institute cannot provide a remedy, and, under the Institute, the young English chemist, who has worked well and faithfully, and whose work is discredited by the careless place-man, will find himself worse off than before.

The evils under which chemists suffer in this country arise in great measure from the many unfortunate appointments which have been made, from the unhealthy condition of the Chemical Society, and from the want of chemical leaders who command our respect. This condition of things will find its own remedy in course of time; but for the present it is not to be remedied even by Act of Parliament, still less by the formation of a "limited liability company."—I am, &c.,

J. Alfred Wanklyn.

St. George's Hospital, London, W.
January 5, 1878.

THE INSTITUTE OF CHEMISTRY.

To the Editor of the Chemical News.

Sir,—I have read, with perfect accord, the letter of "Well Wisher" in the Chemical News of the 4th inst. (vol. xxxvii., p. 8), and would like to supplement his remarks by stating that there are also chemists in London who have not had any knowledge (except in an indirect and unsatisfactory manner) of the formation of the Institute. I should also like to state that even on making application for information, all that was vouchsafed was a half-sheet of paper with the qualifications required printed thereon, with an *intimation* in writing that details of training, *accompanied by certificates* (the underlining was the secretary's), should be forwarded to the Secretary. This is

not, certainly, an encouraging *invitation* to join the Institute.—I am, &c.,

One of the Affronted.

London, January 7, 1878.

THE INSTITUTE OF CHEMISTRY.

To the Editor of the Chemical News.

Sir,—Your correspondent "Well Wisher" has, I think, expressed an opinion that is very widely spread when he comments on the fact that a very scanty advertisement is the only notice respecting the closure of admission to the Institute (by the 2nd of February) for applicants under the original foundation. No intimation has been given as to the annual fee to be paid *after* election, though we are informed that 2 guineas is at present the entrance fee. The Institute, it is believed, has been registered as a "limited liability" company. Does any liability attach to the Fellows beyond an annual subscription? It does not follow that limited liability means limited responsibility, and it may be a question with many whether the payment of a 2-guinea entrance fee and an unknown annual subscription is worth the honour with the liability that may attach thereto. So far as any hindrance from the practice of chemistry to those now at work could be given by such "Institute," none need fear. The Medical and Pharmacy acts both respected those in practice, and the Chemical Institute will be no more able to curtail existing rights than the "Sanitary Institute" can interfere with surveyors and engineers.—I am, &c.,

Nemo me impune lacessit.

ACTION OF SUNLIGHT UPON SOLUTIONS OF OXALIC ACID.—NITRIFICATION.

To the Editor of the Chemical News.

Sir,—In his letter in the Chemical News of January 4 (vol. xxxvii., p. 9), Mr. W. N. Hartley states that he has attributed the instability of oxalic acid solutions to the action of a fungus, and from his account it would appear that under some conditions this might be the case. In the solutions, however, which formed the subject of our experiment, no mycelium was observed, the fluid being absolutely clear. Judging, indeed, from our recent observations on the effect of insolation upon certain of the lower fungi, we should not expect to find mycelium developing in solutions exposed to strong sunlight.

We take this opportunity of drawing attention to the interesting bearing of the observations referred to upon the experiments of Schlœsing and Müntz on nitrification. These chemists in February, 1877, communicated to the French Academy a paper proving, in their opinion, that nitrification is due to the action of an organised ferment; and Warington, in a paper lately read before the Chemical Society, added to their observations the important fact that *darkness* is apparently essential to the process.

The explanation of this, which Mr. Warington confessed that he was unable to furnish, may, we think, be found in the fact, elicited by our own experiments, that light is inimical to the development of such organisms; and thus strong collateral evidence is afforded of the truth of the conclusions arrived at by these gentlemen.—We are, &c.,

Arthur Downes, M.D.
Thos. P. Blunt, M.A.

January 5, 1878.

PS.—Your anonymous correspondent, "H P.," is strangely in error in his assertion (Chemical News, January 4th) that Thorpe, in his paper on the carbonic acid in the air of tropical Brazil (*Journ. Chem. Soc.*, 1867), states that he had to abandon the use of oxalic acid solution on account of its rapid alteration of titre in *the strong light of* the tropics. The words in italics are your correspondent's own addition. In Thorpe's origina paper the sentence stands thus:—"Hydrochloric acid was substituted for oxalic acid in the titration of the baryta water, since solutions of the latter acid decompose rapidly in the tropics." Not a work is said about light, and there is no further allusion to the subject.

Of course it is well known to chemists that the standard solution of oxalic acid is unstable, and most of us have, for that reason, abandoned its use.

A. D., T. P. B.

AMMONIA IN FILTERED WATER.

To the Editor of the Chemical News.

Sir,—Having occasion about a year ago to test the powers of a "spongy iron filter," I was struck by finding the quantity of free ammonia in the filtrates much greater than could have proceeded from the destruction of the organic matter, plus original free ammonia in the waters used for the experiments; but, on reflection, the source of the excessive free ammonia was obvious. I do not, however, think that any chemist would be likely to condemn a water because of excessive free ammonia found under such conditions. I may say that in no case did I find the tremendous quantity of ammonia obtained by Mr. T. Jones. I found also in these experiments that some of the filtrates had a metallic taste, but as the filtered water was generally more or less turbid, this was no doubt due mainly to iron in suspension—particles of the filtering medium washed through. I had not, unfortunately, the opportunity for thoroughly investigating everything connected with this strange filter.—I am, &c.,

Harold H. Slater.

January 7, 1878.

AMMONIA IN FILTERED WATER.

To the Editor of the Chemical News.

Sir,—I think Mr. T. Jones will find that the following quotations explain the phenomenon he describes:—"It is, however, quite certain that there is also a reducing action taking place when ordinary water is passed through spongy iron. This is clearly indicated by the reduction of nitrates (Chem. News, vol. xxxvi., p. 3). Spongy iron reduces nitrates and nitrites, converting only a small portion of their nitrogen into ammonia. (*Sixth Report of the Rivers Commission*, p. 220).

The well water examined by Mr. T. Jones must have contained a very large amount of nitrates and nitrites to give so much ammonia.—I am, &c.,

B. J. Grosjean.

J. B. Lawes's Chemical Works, Millwall, E.
January 9, 1878.

NATURE'S HYGIENE.

To the Editor of the Chemical News.

Sir,—In the Chemical News of the 28th of December, 1877 (vol. xxxvi., p. 283), in a review of a pamphlet entitled "Nature's Hygiene and its Artificial Imitation," the following remark occurs:—"Before explaining the mysterious agency of certain plants and trees, would it not be well first to place beyond a doubt the existence of such an agency, and to ascertain its conditions and limits?"

I believe that an inquiry directed to this end, and properly conducted, would be of infinite value to real sanitary science, and would do much to dissipate some mischievous delusions. As bearing on such an enquiry, I shall be glad if you will allow me to mention two cases which occur to me, in which trees seem to have affected, in a marked manner, the health of the population in their immediate neighbourhood,

The cantonment of Gorukpore, in North-west India, though near the forest and in the neighbourhood o a

large swamp, was, some 30 years ago, considered a healthy station. A large grove of mango trees existed between the swamp and the station. For some reason this grove was cut down, and the station became unhealthy. I think I have heard that the trees having been replanted the station has again become healthy.

The other case is that of the Civil station of Futtehpoor, situated between Allahabad and Cawnpoor, in an arid plain, but near a somewhat extensive marsh. This place was considered extremely unhealthy until the Magistrate, who was, I think, the present Sir William Muir, planted between the station and swamp a belt of the quick-growing babool tree. As the trees grew the place became much less unhealthy.

I believe that I have correctly stated the facts in the cases mentioned, and if so, it would appear that the trees acted as screens or filters, and so protected the population from the effect of the malaria generated in the swamps beyond them.

I may mention that it would be difficult to find trees with more dissimilar foliage than the mango and the babool.

Is it not probable that where beneficial effects have followed the planting of the Eucalyptus, they may be due as much to the screen which the plantation has interposed as to any peculiar or specific action of, or exhalation from, the leaves or stem of the tree?

The often-quoted case of the Trappist Monastery at Tre Fontane, near Rome, does not seem to be evidence of the peculiar virtue of the Eucalyptus. There is, unhappily, no doubt that the place was fatal to human life. Of the Trappist monks who were sent, some few years ago, to re-occupy the site, not one, I believe, survives; but their numbers were recruited, they persevered, and the ground around has now been deeply cultivated; 700 cartloads of human bones have been removed. (The place was the execution ground and burial place for criminals of old Rome.) A vineyard has been planted, young Eucalypti are growing round the garden, and doubtless the air is somewhat less deadly. It is not easy to determine how much of the improvement is due to the screen of the Eucalypti and how much to the other operations. The monks believe in the Eucalyptus. They make what they call an "elixir" of the leaves for sale, and, I was told, take a dose of the elixir every morning before eating anything.

As I am not inclined to enter into any controversy, I hope if you print this letter you will allow me to sign myself merely

A Reader of the Chemical News.

January 5, 1878.

STOP-COCK FLASK.

To the Editor of the Chemical News.

Sir,—In the Chemical News of January 4, 1878 (vol. xxxvii., p. 7), Dr. Corfield figures and describes an apparatus which he calls a "stop-cock flask," but which appears to me to be only a particular form of a separating funnel.

The idea of separating fatty acids in a flask is, however, not new. If Dr. Corfield turns to the *Analyst* of October, 1877, he will find a paper there by the present writer, entitled "Easy and Rapid Method of Manipulating Fatty Acids," in which is described an adaptation of Mohr's well-known flask, figured at p. 130 of his "Chemische Toxicologie," Braunschweig, 1874. My flask is about 350 c.c. capacity; it has a long and narrow neck, and a doubly perforated cork or stopper; the cork carries two tubes, the one reaching nearly to the bottom of the flask, and bent externally in a syphon form, its use being to let in the air; the other provided with a stop-cock to let out the liquid on the inversion of the flask. The fat is saponified, the soap decomposed, and the fatty acids washed and separated, all in the same flask. There is no transference of the liquid from one vessel to the other. The materials are in every one's laboratory, and the method is, I believe, superior to that advocated by Dr. Corfield.

With regard to the drying of the fatty acids, I find it most convenient, as recommended by Mr. Jones (*Analyst*, May, 1877), to pour the melted fatty acids into a porcelain dish, dissolving every trace from the flask with ether.—I am, &c.,

A. Wynter Blyth.

Barnstaple, January 5, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Academié des Sciences. No. 25, December 17, 1877.

Reproduction of the Sulphide, Selenide, and Telluride of Silver in a Crystalline State, and of Filiform Silver.—M. J. Margattet.—Silver, gold, and occasionally copper, are met with in nature in filaments, the appearance of which recalls that of a metal passed through a wire-drawing apparatus. These three metals may be artificially obtained by the dry way in this filiform condition on reducing their sulphides, selenides, and tellurides with hydrogen. The author obtains crystalline sulphide by passing the vapour of sulphur, carried slowly along by a current of hydrogen over silver at a dull red heat. As soon as the sulphur comes in contact with the silver, the latter is covered with crystals of silver sulphide, which increase in size and number until the silver is completely sulphuretted. The current of sulphur must be very slow. The composition and the physical properties of the artificial product are the same as those of the native sulphide, AgS. Its form is that of a rhomboidal dodecahedron. The selenide and telluride of silver are obtained in an analogous manner. The former is steel-grey and very brilliant, and crystallises in the regular system in the form of a rhomboidal dodecahedron. Silver telluride is black, and is obtained in chaplets of regular octahedra, united by their summits. Crystalline silver sulphide is entirely converted into filiform metallic silver by a current of dry hydrogen at a temperature of 440°. Metallic silver appears at the outset of the operation in the form of small tufts implanted on the surface of the crystals of sulphide; as the reduction continues these tufts become threads, which increase in length and thickness at the expense of the silver continually set at liberty by the hydrogen. After some time they present the aspect of ribbons twisted in a spiral, mixed with small threads of extreme fineness, the whole supported by crystals of sulphide which have preserved their original form. The silver liberated presents no trace of a crystalline texture. The specimens thus obtained closely resemble the native associations of crystalline silver sulphide and of filiform silver so often met with. The selenide and telluride of silver yield also filiform metallic silver, but the reduction only sets in at a higher temperature.

Use of the Lakes of Eosin and Fluorescein for the Preparation of Decorative Paintings Without Poison.—M. E. Turpin.—A solution of the potassic or sodic eosin of commerce, treated with an acid, yields a precipitate of eosic acid, insoluble in water. This precipitate, if washed until the water begins to turn rose-colour, is insoluble in the hydrate of the oxide of zinc, and forms thus a very rich lake, which may vary from a rose to a deep red, according to the quantity of eosic acid employed. This acid, dissolved in a solution of sodic car-

bonate and precipitated with potash-alum, likewise gives a very rich lake. These lakes resist elevated temperatures and sulphurous emanations, and may be used in the colouration, in the mass, of vulcanised india-rubber, withstanding perfectly the degree of temperature required for vulcanisation and the disengagement of sulphuretted hydrogen which ensues during the reaction. The colours obtained with these lakes are in this case incomparably finer than the shades obtained with mercuric sulphide (vermilion) and antimonic sulphide, and may serve as substitutes for these colours in painting, and have the advantage of being harmless. Pure fluorescein likewise forms a yellow lake with hydrated zinc oxide. If eosin and fluorescein are employed conjointly they yield lakes capable of replacing the reds and oranges obtained from lead, as minium, orange minium, &c. Zinc chromate, if treated with a potassic solution of eosin and the eosic acid liberated by the addition of alum, yields, on evaporation to dryness, lakes remarkable for the brightness of their shades, which may range from a pale yellow to a lively red, and which may serve as substitutes for the poisonous chromates of lead. These products, although attacked by water, may be advantageously employed in painting, for they are absolutely indecomposable by oils and essences, cover well, and can be prepared cheaply. With the aid of these new colours and certain others, the author has reproduced approximately, with-non-poisonous colours, the chromatic table of M. Chevreul.

Action of the Oxychloride of Carbon upon Toluene in presence of Aluminic Chloride.—MM. E. Ador and J. M. Crafts.—The authors find that in consequence of this action hydrogen is removed not from the methyl group but from the radical C_6H_5, aceton being obtained as a final product.

Remarks on the Action of Stable Anhydrous Acids upon Stable Anhydrous Bases: Explosion of the Compound.—MM. E. Solvay and R. Lucion.—The authors observe that a mixture of anhydrous phosphoric acid with anhydrous oxide of sodium may remain without reaction at the ordinary temperature, but an elevation of temperature to 100° determines instant combination with remarkable violence, amounting in one instance to explosion. This instantaneous character of the combination excludes, they consider, the hypothesis of the presence of a trace of water in M. Béchamp's experiments on the same subject. M. Lucion objects, however, to the inference drawn by M. Béchamp from these phenomena.

Maturation and Diseases of the Cheese of the Cantal.—M. E. Duclaux.—The principal fact in the ripening of the cheeses of Cantal, and, without doubt, of many others, is the gradual transformation of the casein insoluble in water into two albumens soluble in that liquid. The large amount of water in Cantal cheese (45 per cent) gives opportunity for the sugar of milk remaining in the curd to undergo fermentation, sometimes alcoholic, more commonly lactic, with a great tendency to become butyric.

Measurement of the Diedric Angles of Microscopic Crystals.—M. Em. Bertrand.—Not suitable for abstraction.

Preparation of Alcoholic Chlorides, and their Application to the Production of Colouring Substances.—MM. P. Monnet and F. Reverdin.—The green colouring matter known in commerce under the name of methylaniline green was prepared hitherto by causing the nitrate of methyl to act upon an alcoholic and alkaline solution of methylaniline violet. The facts which the preparation and the industrial employment of methyl-nitrate present have led the authors to search for another method. They have, since March, 1874, caused methyl chloride to act upon methylaniline violet in an alkaline alcoholic solution. They produce methyl chloride by heating a mixture of one molecule of methylic alcohol and one molecule of hydrochloric acid (commercial acid at 23° B.) to 100° in a closed autoclave for several hours. The pressure rises to 30—35 atmospheres. The product of the reaction, distilled with an alkali, is filtered to separate the base of the violet; the filtrate containing the base of the green is then treated with an acid and a salt of zinc to form the corresponding double salt of aniline-green and of zinc, and the colouring matter is then precipitated by means of common salt. If rosaniline is substituted for methylaniline violet, we obtain the colouring matter known as Hofmann's violet, hitherto prepared by the action of methyl iodide upon rosaniline hydrochlorate. What has been said of the preparation of methyl chloride applies equally to the preparation of the other chlorides of alcohol radicals, modifying the conditions of pressure and temperature. Ethyl chloride acts in the same manner as methyl chloride upon methylaniline violet and upon rosaniline hydrochlorate, and is prepared under the same conditions. The yield of ethyl chloride is 60 per cent of the theoretical quantity.

Bulletin de la Societe Chimique de Paris, No. 12, December 20, 1877.

Thermic Formation of Isomeric Bodies.—M. Berthelot.—The experiments described, which have been extended to about thirty compounds, including alcohols, aldehyds, fatty acids and their salts, acid chlorides and bromides, sulpho-conjugated acids, &c., conduct to this important conclusion: isomeric bodies of the same chemical function are formed from their elements with disengagements of heat almost equal; thus their reciprocal metamorphosis liberates very little heat. Finally, the same relations exist in the formation of their isomeric derivatives.

New Remarks on the Quantities of Heat Liberated on Mixing Water with Sulphuric Acid.—M. Berthelot.—Already noticed.

Limits of Etherification.—M. Berthelot.—The experiments described verify the general laws of etherification, and especially the identity of the limits of combination between the acids and the alcohols from the ordinary temperature up to 260°.

Heat Liberated by Chemical Combinations in the Gaseous State: Anhydrous Acids and Water.—M. Berthelot.—A thermo-chemical study of the synthesis of nitric acid. The author remarks that the reactions which he describes, so simple for those who write water HO, and the anhydrous acids NO_5 and $C_4H_3O_3 = 2$ vols. become complicated in the atomic notation. It is not one of the smallest inconveniences of this notation to have made disappear from the science the simple notion of anhydrous acids and anhydrous bases; that is to say, to suppress or complicate an entire order of positive facts and of relations given by experience, because the new language was unable to express them.

Researches on Chloral and on its Hydrate.—M. Berthelot.—There is liberation of heat in the reaction of gaseous chloral upon gaseous water with formation of a gaseous compound. The gaseous hydrate of chloral exists then veritably as a compound distinct from a mere mixture of the two vapours. This conclusion is conformable to the results obtained by M. Troost from the study of the tensions of dissociation. It is supported by this fact that anhydrous chloral does not combine instantaneously with water, but condenses in it first in the form of an oil which only dissolves by degrees even on agitation; whilst, on the contrary, chloral hydrate in vapour condenses under water in the state of a crystalline hydrate, if not agitated, and dissolves at once on stirring.

Physical Properties of Quercite.—L. Prunier.—An account of the crystalline form, rotatory power, specific gravity, and solubility of this compound.

Synthesis of Indol.—M. Maurice Prudhomme.—In 1873 the author obtained indol by setting out from the bases obtained by Hofmann by the action of bibromide of

ethylen upon aniline. If the crude product of this reaction is distilled with zinc powder it gives the odour characteristic of indol and of indigo.

Russian Chemical Society.—Session of Sept. 8/20 and Oct. 6/18, 1877.—Noticed elsewhere.

Determination of Albumen in Serum and in Milk.—J. Puls.—To determine albumen in serum the author acidulates the acetic acid and adds alcohol till the mixture contains 70 per cent. of the latter. He boils and washes the precipitate first with alcohol at 70 per cent. and then with absolute alcohol. The precipitate is dried, weighed, incinerated, and the weight of the ash is deducted from the weight of the dry matter. The alcoholic filtrate is free from albumen. The author has found in seven experiments quantities of albumen varying from 7·92 to 7·99 per cent. In cows' milk he has found 3·40 to 3·43 of albumen, and has ascertained that milk-sugar is soluble in alcohol, and therefore does not affect the results. Woman's milk contains 0·95 per cent. of albumen. —*Pflüger's Archiv.*, xiii., 476.

Use of Ferrocyanide in Electro-gilding.—Ed. Ebermayer.—In a capsule holding 4 litres are dissolved 300 grms. ferrocyanide, 100 grms. carbonate of potash, and 50 grms. sal-ammoniac. On the other hand, 100 grms. of gold are dissolved in aqua-regia, the excess of acid driven off, and the chloride of gold dissolved in water so as to make up 1 litre. Of this liquid, 200 c.c. are added, little by little, to the ferrocyanide solution; the mixture takes a blue colour, which disappears gradually on boiling, whilst ferric oxide is precipitated. The liquid is let cool, filtered, and made up to 5 litres. This is the gilding-bath. As it is a bad conductor and deposits ferric oxide upon the anodes, the author adds a small quantity of cyanide, not sufficient, however, to evolve hydrocyanic acid on boiling, The gilding is performed at 40° to 50°. When the bath no longer gives a good deposit 200 c.c. of the solution of chloride of gold are again added in the same manner, continuing thus till all the gold is consumed. But if the bath is to be used for still further quantities of gold 1-10th of the quantity of salts direcd above must be added to the bath. To recover the gold remaining in the bath when no longer fit for gilding, the author precipitates it electrolytically upon a plate of copper, but it requires to be refined. The object of the process is to avoid the use of large quantities of cyanide of potassium, so objectionable from a sanitary point of view.—*Dingler's Polytech. Journal.*

Use of Chlorhydrin in Tanneries.—M. Sedlon.—Since Knapp showed that the yelk of egg acts principally by means of the emulsified oil which it contains attempts have often been made to substitute other oils in a finely divided state. The author proposes for this purpose an emulsion of oil of chlorhydrin, prepared by the reaction of glycerin and hydrochloric acid.—*Dingler's Polytech. Journal.*

Reimann's Färber Zeitung,
No. 45, 1877.

Pollution of Rivers Extraordinary.—It appears that on November 10 7 cwts. of arsenic were plunged into the Rhine by the sinking of a vessel between Vallendar and Bendorf. The daily papers, so anxious as regards dyes supposed to contain traces of arsenic, take this accident very cooly.

No. 46, 1877.

Part Played by Milk of Sulphur in Dyeing.—This interesting paper has been already noticed in the proceedings of the German Chemical Society.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 12, November 22, 1877.

The *Revue Allemande* denounces the use of arsenic, not in dyes, but in mordants and mixtures used in finishing cotton goods, and which sometimes contain arseniate of soda to the extent of one-sixth part of their weight.

No. 13, November 29, 1877.

This issue contains no original chemical matter.

MISCELLANEOUS.

The Telephone.—At the meeting of the Medical and Physical Society here to-day, Professor Fick exhibited the action of telephonic sounds on the muscles of frogs. The two ends of the telephone wires are placed in contact with the leg muscles of the frog, and the operator speaks into the telephone. The production of the sounds *a*, *e*, *i* has scarcely any raneïc effect; whilst *o*, and especially *u*, produce a most violent convulsion, although spoken much more faintly than the *a*, *e*, *i* sounds. The pronunciation of the word "*Zucker*," even in a low tone, causes the preparation to jump, whilst the very loudly-spoken command, "*liege still*," has a scarcely sensible effect.

W. R. H.

Würzburg, Jan. 5, 1878.

Russian Scientific News.—The excellent invention of M. Jablochkoff was recently illustrated in a lecture on electric light by Mr. Tchikaleff, in the Russian Technical Society. It appears that the electric candle, in order to be properly managed, requires magneto-electric machines, with a changeable current, which are far dearer than machines with constant current. A candle 0·12 metre long will burn 30 minutes, giving a light equal to 250 candles (normal), and costs 50 centimes, so that a light of 1000 candles during one hour costs 4 francs, besides the cost of working the machine. In using an ordinary regulator the same intensity of light may be obtained by burning 0·1 metre of coke-stick, which costs 2½ centimes. The lighting of the Palais d'Industrie in Paris by Jablochkoff's candles would cost 600,000 francs, instead of 50,000 francs, the cost of the ordinary regulator arrangement for the same purpose. However ingenious is this invention, there is much yet to be done in order to adapt this system for practical use.

M. Gesechus is engaged in some experiments on the action of hydrogen on the co-efficients of elasticity of palladium, and of the alloys of silver and gold with palladium. The experiments proved that the coefficients of elasticity diminish during the absorption of the hydrogen by the wires; the strongest effect was remarked during the use of palladio-silver wires (75 per cent of Pd, 25 per cent of Ag). Before and after the evolution of hydrogen the coefficients of elasticity were remarked to be the same.

Prof. Petrouchevsky is in the course of studying the moon photometrically. Several instruments devised by him are nearly ready. As a unit of light in his researches, the Professor desires to use the light of the full moon; in using such a unit, and comparing the light of different places on the moon with the light of the area of the moon, the changes in lucidity of our own atmosphere will have no serious action on the photometric observations. During the phases he will use Zollner's comparative tables. The apparatus of Prof. Petrouchevsky differ much from the apparatus of M. Vogel, used by him during his last elaborated researches on the absorption of light by the solar atmosphere.

The Graham-Bell telephone is here also the great attraction of the day. Several firms are now selling this instrument, but the price is rather too high (£1). The simplicity of this ingenious invention is indeed astonishing. The diffusion of another very useful invention, the "electric pen," which is well known in England, is much checked by Government regulations, as the use of printing implements for private use is strictly forbidden in this country.

S. Kern, M.E.

St. Petersburg.

THE CHEMICAL NEWS.

Vol. XXXVII. No. 947.

LIQUEFACTION AND SOLIDIFICATION OF HYDROGEN.

M. Raoul Pictet telegraphs from Geneva as follows:—

"Geneva, January 11th, 10.30 a.m. I have liquefied hydrogen at 650 atmospheres and 140 degrees of cold. It solidifies by evaporation. Intermittent jet of a steel-blue colour. Violent projection, like small shot, on the ground, with a very characteristic harsh shrill sound. Hydrogen retains the solid state in the tube for several minutes."

We read in the *Journal de Genève* that on Thursday evening, January 10th, M. Raoul Pictet succeeded in liquefying hydrogen gas in the laboratories of the Society for the Construction of Physical Instruments, at Plainpalais.

The experiment, which was performed in the presence of several people, succeeded perfectly. The process consists in decomposing formiate of potash by caustic potash, a reaction which, as proved by M. Berthelot, gives hydrogen absolutely pure. The pressure commenced to rise at half-past eight; gradually and without any stoppage it attained, at seven minutes past nine, 650 atmospheres, at which point it remained steady for a few instants. At this moment the tap was opened, and a steel-blue jet escaped from the orifice, producing a hissing sound like a bar of red-hot iron plunged into water.

The jet suddenly became intermittent, and there could be observed a hail of solid particles projected violently to the ground, on which their fall produced a crackling noise. The tap was closed, and the pressure, which was then at 370 atmospheres, gradually descended to 320, where it remained for some minutes. It then rose to 325. At this moment the tap, on being opened a second time, only allowed a jet to escape intermittently, rendering it evident that a crystallisation had taken place in the interior of the tube. The proof of this can be established by the escape of hydrogen in the liquid state when the temperature begins to rise on stopping the pumps.

Thus has been experimentally demonstrated the liquefaction, and especially the solidification, of this gas, which from its properties has always been considered probably to belong to the class of metals.

METALLURGICAL NOTES.

By SERGIUS KERN, M.E. St. Petersburg.

I. On certain Gold Alloys.

The author having analysed, some time ago, several gold alloys, obtained by melting crude gold direct from the mines, thinks that some remarks referring to these alloys may be of interest.

The aspect of these alloys presented nothing particular. Under the microscope a rather crystalline structure was observed.

When forged the specimen plates prepared from these alloys tore easily; indeed they were very brittle.

The analysis of these alloys are as follows:—

	No. 1. Per cent.	No. 2. Per cent.	No. 3. Per cent.
Gold	99·46	99·280	98·50
Silver	0·52	0·640	1·48
Lead	traces	0·005	traces
Copper	0·01	0·070	0·01
Bismuth	0·01	0·005	0·02

The alloy No. 2 could be hammered in the cold, but on being forged in a heated state it fell to pieces.

	No. 1. Per cent.	No. 2. Per cent.
Gold	94·20	96·75
Silver	5·76	3·17
Iron	traces	none
Copper	0·01	0·06
Lead	0·01	0·01

A certain quantity of these alloys, well washed, in a divided state, in nitric acid, and refined by cupellation, was fused into ingots in a gas-furnace. The ingots obtained showed no brittleness whatever, and forged very well. The analysis detected no presence of lead, bismuth, or iron.

These results confirm the elaborate experiments of Mr. Chandler Roberts, who showed that even traces of lead, antimony, bismuth, or arsenic impart brittleness to gold alloys (*Dingl. Journ.*, 1871). The author can give no decided opinion on the action of traces of arsenic on gold alloys, as in specially prepared alloys which were found to contain notable traces of arsenic no brittleness was remarked.

It must be mentioned, however, that gold alloys containing 0·05 to 0·08 per cent of arsenic could not be readily worked under the hammer.

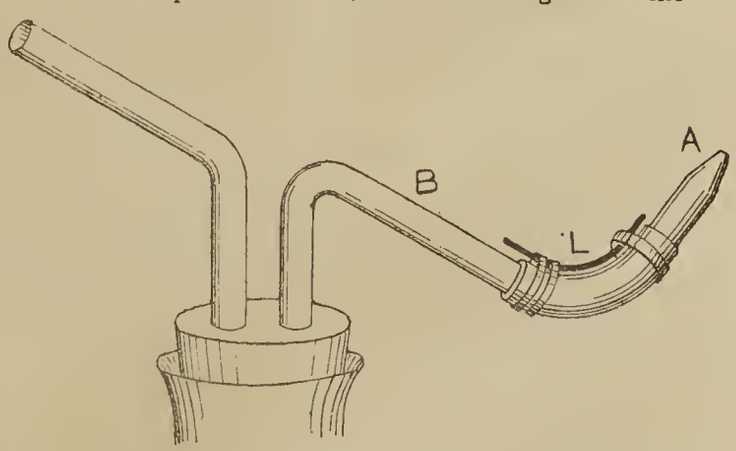
II. On Demidoff's Iron.

In an English journal the author found a statement that the Russian iron from Demidoff's works, at Nischnetagilsk (Oural Mountains), is indebted for the peculiar qualities to the phosphorus it contains (*Journ. Soc. Arts*, No. 1239, p. 901). The mark of this iron is CCND. All the iron prepared at the above-mentioned works is manufactured from the best Oural iron-ores, free from phosphorus and sulphur. Sulphur is indeed sometimes found as traces, but phosphorus never. The resulting iron is well known in Europe. It is so pure and soft that by rolling it in ordinary rolling-mills sheet iron is obtained a square inch of which weighs only 0·130 grm.

MOVABLE JET FOR WASH-BOTTLE.

By C. J. WOODWARD.

Instead of the arrangement figured in Thorpe's "Analysis" I have used the following form of movable jet, which enables the operator to direct a stream of water in any required direction. The jet, A, is attached to the tube, B, by a piece of india-rubber tubing, a sufficient space being left between the two tubes for A to play about in any direction. A strip of sheet lead, somewhat longer than the



india-rubber tube, and about one-eighth of an inch broad, is tied on as represented at L. Thus arranged the jet may be turned about, and the strip of lead retains the jet in whatever position it is placed. It is an advantage to fasten that end of the lead near the jet, A, with a band, as this can easily be slipped off if it be desired to use the jet without the lead attachment.

Birmingham and Midland Institute.

APPLICATION OF ORGANIC ACIDS TO THE EXAMINATION OF MINERALS.

By H. CARRINGTON BOLTON.

(Continued from p. 14).

V. SILICATES.

Mineral.	Formula.	Description.	Locality.
Wollastonite.....	$\dot{C}a\ddot{S}i$	fibrous.....	Natural Bridge, N.Y.
Diopside.....	$(\dot{C}a\dot{M}g)\ddot{S}i$	crystals	Tyrol.
Augite.....	$(\dot{C}a\dot{M}g\dot{F}e)(\ddot{S}i\dddot{A}l^{\frac{2}{3}})$	crystals	Sicily.
Rhodonite	$\dot{M}n\ddot{S}i$	massive	Franklin, N. .
Spodumene	$\dot{R}^3\ddot{S}i^3+4\dddot{A}l\ddot{S}i^3$	crystals	Windham, Me.
Hornblende	$(\dot{R}\dddot{R})(\ddot{S}i\dddot{A}l^{\frac{2}{3}})$	massive	New York City.
Chrysolite	$(\dot{M}g\dot{F}e)^2\ddot{S}i$	massive	North Carolina.
Olivine	$(\dot{M}g\dot{F}e)^2\ddot{S}i$	granular.....	Sandwich Islands.
Willemite	$\dot{Z}n^2\ddot{S}i$	massive	Franklin, N.J.
Almandite	$(\frac{1}{3}\dot{F}e^3+\frac{1}{3}\dddot{A}l)^2\ddot{S}i^3$	crystals	Sterling, N.J.
Epidote	$[\frac{1}{3}\dot{C}a^3+\frac{2}{3}(\dddot{A}l\dot{F}e)]\ddot{S}i^3$	massive	Ducktown, Tenn.
Biotite	$\frac{1}{2}(\dot{M}g\dot{K})^3+\frac{1}{2}(\dddot{A}l\dot{F}e)^2\ddot{S}i^3$	laminæ	Westchester Co., N.Y.
Muscovite	$(\dot{R}^3\dddot{R})_2\ddot{S}i^3+\frac{3}{4}\ddot{S}i$	laminæ	North Carolina.
Wernerite	$[\frac{1}{3}(\dot{N}a\dot{C}a)^3+\frac{2}{3}\dddot{A}l]^2\ddot{S}i^3+\ddot{S}i$	massive	Gouverneur, N.Y.
Labradorite	$[\frac{1}{4}(\dot{C}a\dot{N}a)^3+\frac{3}{4}\dddot{A}l]^2+\frac{3}{2}\ddot{S}i^3$	massive	Turin, N.Y.
Albite	$(\frac{1}{4}\dot{N}a^3+\frac{3}{4}\dddot{A}l^2\ddot{S}i^3+6\ddot{S}i$	massive	Yancey Co., N. C.
Orthoclase	$(\frac{1}{4}\dot{K}^3+\frac{3}{4}\dddot{A}l^2\ddot{S}i^3+6\ddot{S}i$	massive	New York City.
Chondrodite	$\dot{M}g^8\ddot{S}i^3$ [Fl]	crystals	Sparta, N.J.
Tourmaline	$(\dot{R}^3\dddot{R}\ddot{B})^8\ddot{S}i^9$[Fl]	black crystals.....	New York City.
Kyanite	$\dddot{A}l\ddot{S}i$	crystals	Buncombe Co., N.C.
Datolite	$(\dot{C}a^3\dot{H}^3\dddot{B})\ddot{S}i$	crystals	Lake Superior.
Pectolite.....	$(\frac{4}{6}\dot{C}a+\frac{1}{6}\dot{N}a+\frac{1}{6}\dot{H})\ddot{S}i$	crystals	Bergen, N.J.
Chrysocolla	$\dot{C}u\ddot{S}i+2\dot{H}$	massive	Lake Superior.
Calamine	$\dot{Z}n^2\ddot{S}i+\dot{H}$	crystalline	Friedensville, Pa.
Prehnite.....	$(\frac{1}{6}\dot{H}^3+\frac{2}{6}\dot{C}a^3+\frac{3}{6}\dddot{A}l)^2\ddot{S}i^3$	uniform, massive	Scotland.
Apophyllite	$[\frac{1}{2}\dot{H}+\frac{1}{2}(\frac{1}{5}\dot{K}+\frac{3}{5}\dot{C}a)]^2\ddot{S}i+\ddot{H}\ddot{S}i$	crystals	Bergen, N.J.
Natrolite (1)	$3\ddot{S}i,\dddot{A}l,\dot{N}a,2\dot{H}$	dark, massive	Wurtemberg.
,, (2)		white, fibrous	Bergen, N.J.
Analcite.....	$4\ddot{S}i,\dddot{A}l,\dot{N}a2\dot{H}$	fine crystals	Lake Superior.
Chabazite	$4\ddot{S}i,\dddot{A}l\,[\frac{1}{6}\dot{C}a+\frac{1}{6}(\dot{N}a\dot{K})]6\dot{H}$	crystals	Nova Scotia.
Stilbite	$6\ddot{S}i,\dddot{A}l,\dot{C}a,6\dot{H}$	crystals	Nova Scotia.
Talc	$(\frac{1}{6}\dot{H}+\frac{5}{6}\dot{M}g)\ddot{S}i$	massive	North Carolina.
Serpentine	$\dot{M}g_2\ddot{S}i+\dot{H}$	massive	Newburyport, Mass.
Retinalite	$\dot{M}g_2\ddot{S}i+\dot{H}$	waxy translucent.....	Montville, N.J.

Mineral.	Formula.	Description.	Locality.
Chrysotile	$\dot{\dot{M}}g_2\dot{\dot{S}}i+H$	silky, fibrous	Montville, N.J.
Deweylite	$(\frac{2}{3}\dot{\dot{M}}g+\frac{1}{3}H)^2\dot{\dot{S}}i+\frac{4}{3}H$	massive, translucent ..	Rye, N.Y.
Ripidolite	$8(\frac{5}{8}\dot{\dot{M}}g^3+\frac{3}{8}\dot{\dot{A}}l\dot{\dot{F}}e)2\dot{\dot{S}}i,12H$	laminæ	North Carolina.

[Ninety Species, One hundred and twenty Specimens.]

(To be continued).

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, December 11, 1877.

E. W. Binney, F.R.S., F.G.S., President, in the Chair.

"*Note on Metallic Niobium and a New Niobium Chloride*," by Professor H. E. Roscoe, F.R.S., &c.

The history of the investigation of the two closely related metals niobium and tantalum is of interest as showing how step by step the difficulties and uncertainties which surround the examination of analogous and rare substances such as these are overcome; and I may therefore be allowed shortly to state the growth of our knowledge on this subject.

In the year 1801 Hatchett discovered a new metal in the mineral columbite from Massachusetts, and to this he gave the name of columbium. Ekeberg a year later found a similar new metal in a rare Swedish mineral, and to it he gave the name tantalum. Wollaston, in 1809, came to the conclusion that these two metals were identical. Berzelius next examined the metal contained in the Swedish tantalite, and afterwards Wöhler found these metals in several other minerals. Heinrich Rose next investigated this subject, but in spite of persistent effort the results of his experiments left the matter in a still less satisfactory condition, inasmuch as he first came to the conclusion that two more new metals were contained in these minerals, to which he gave the names of niobium and pelopium, whilst at a later period he decided that both niobic and pelopic acids were different oxides of the same metal, for which he proposed the names niobic and hyponiobic acids.

Then, again, in 1860, Von Kobell thought that he had found a fourth new metal, which he called dianium, in the same minerals, and Hermann believed that he had discovered in them a fifth metal, to which he gave the name ilmenium. It is to Marignac and Bloomstrand that we owe a deliverance from this state of contradiction and uncertainty. They independently proved that only two metals in reality exist—niobium and tantalum—and that these are present in varying proportion in most of the minerals in question. They showed that the compounds derived from Rose's niobic oxide contain mixtures of niobic and tantalic oxides, whilst his hyponiobic oxide is pure niobic oxide.

Bloomstrand arrived at this result by a series of analyses of the chlorides. He proved that the white hyponiobic chloride of Rose is in fact an oxychloride, whilst the yellow niobic chloride contains no oxygen.

Marignac, on the other hand, came to a similar conclusion by an investigation of the fluorides of niobium and tantalum, and pointed out that the oxides are pentoxides, Nb_2O_5 and Ta_2O_5, whilst the niobium chloride and oxychloride are represented respectively by the formulæ $NbCl_5$ and $NbOCl_3$.

All the other supposed metals turned out to be either simple mixtures of these two in varying proportions, or such a mixture containing in addition some other metal, such as tungsten, titanium, or iron.

Troost determined the vapour densities of niobium pentachloride and oxychloride, obtaining the numbers 9·6 for the first and 7·87 for the second, agreeing closely with the calculated densities when the atomic weight of niobium is taken to be 94.

Some time ago I obtained several crystals of Greenland columbite which possessed a specific gravity of 5·389 and which contains, as Marignac has shown, little or no tantalum. From this material I prepared nobium pentoxide (Nb_2O_5), niobium pentachloride ($NbCl_5$), and niobium oxychloride ($NbOCl_3$) by well known methods.

I have likewise prepared metallic niobium and a new chloride of niobium. The results of these experiments are contained in the following communication.

The following results of analysis of the pentachloride and oxychloride serve to show the purity of the material

	Pentachloride. Calculated.	Found.
Niobium	34·62	34·38
Chlorine	65·38	65·55
	100·00	99·93

	Oxychloride. Calculated.	Found.
Niobium	43·42	42·93
Chlorine	49·19	49·34
Oxygen (Diff.).. ..	7·39	7·73
	100·00	100·00

Metallic Niobium is difficult to prepare, and precautions, similar to those employed for the preparation of metallic vanadium, must be taken. It is obtained as a bright steel-grey, shining, metallic crust by passing the vapour of the pentachloride mixed with hydrogen repeatedly through a red-hot glass tube. The metallic crust, then deposited on the side of the tube, is next strongly ignited in a porcelain tube in a current of hydrogen until no further evolution of hydrochloric acid occurs.

In order to avoid as completely as possible access of traces of oxygen, the very hygroscopic pentachloride was prepared in a narrow tube, and this was transferred bodily into the wider tube, in which the preliminary heating with hydrogen takes place.

The metal thus obtained was analysed by placing a weighed quantity in a porcelain boat and heating it in a glass tube in a current of air. The metal takes fire and burns brightly to the pentoxide, a small trace of oxychloride being usually deposited, existing as impurity in the metal. In one instance when the metal was allowed to oxidise very slowly, the formation of an indigo-blue-coloured lower oxide was first observed; this afterwards passed into the yellow pentoxide on further heating.

The following analyses were made with metal obtained in two distinct operations:—

I. Weight of metallic niobium taken .. 0·3963 grm.
" niobium pentoxide obtained.. 0·5480 "

This corresponds to 0·3810 of metal; or the substance contains 96·14 per cent of niobium.

II. Weight of metallic niobium taken .. 0·3900 grm
" niobium pentoxide obtained.. 0·5403 "

This corresponds to 0·3790 of metal; or the substance contains 97·18 per cent of niobium.

That the substance thus prepared is not, as has been supposed, a hydride, is shown by the fact that the second of the above specimens on analysis was found to contain only 0·27 per cent of hydrogen.

Metallic niobium possesses a steel-grey colour and bright metallic lustre. It is remarkable that it is not attacked in the cold by hydrochloric or nitric acids, either dilute or concentrated, or even by *aqua regia*. Strong sulphuric acid, on the other hand, dissolves the metal quickly, yielding a colourless solution. The metal does not take fire in chlorine gas at the ordinary temperature, but it does so when gently heated, with formation of pentachloride and a trace of oxychloride, owing to the unavoidable presence of a small quantity of oxygen in the metal experimented with.

The specific gravity of metallic niobium at 15·5° is 7·06 as a mean of two well-agreeing determinations made with half a gramme of substance.

Niobium Trichloride, $NbCl_3$.—When the vapour of niobium pentachloride is passed through a heated glass tube it is slowly decomposed, a black deposit of trichloride being formed on the sides of the tube. Niobium trichloride is generally obtained as a black crystalline crust which possesses an almost metallic lustre, and closely resembles in appearance that of a film of sublimed iodine. It is sometimes deposited in long needle-shaped crystals which exhibit a dichroic lustre. The trichloride is non-volatile, it is not deliquescent, nor is it decomposed by water or ammonia, but when brought into contact with dilute nitric acid it is at once converted into niobic and hydrochloric acids. Heated in the air it emits dense white fumes.

For the purpose of analysis the trichloride, from several different preparations, was, in some cases, decomposed by nitric acid directly, and in others first fused with sodium carbonate and the fused mass treated with nitric acid.

	No. I.	No. II.	No. III.
Substance taken	0·2781	0·4406	0·5344
Nb_2O obtained	0·1930	0·3000	0·3611
AgCl	0·5681	0·9333	1·1218

	Calculated.	No. I.	No. II.	No. III.
Niobium, Nb ..	46·88	46·68	47·76	47·42
Chlorine, Cl_3 ..	53·12	52·53	52·40	51·93
	100·00	99·21	100·16	99·35

When the vapour of niobium oxychloride is passed over red-hot charcoal in an atmosphere of carbon dioxide no change occurs, and the pentachloride is obtained when the carbon dioxide is replaced by chlorine.

A remarkable reaction occurs when niobium trichloride is heated in a current of carbon dioxide; this gas is decomposed, a white sublimate, consisting of oxychloride, is obtained, and the corresponding quantity of carbon monoxide is formed.

That this is the case was ascertained by analysing the oxychloride and by collecting the gas over caustic potash and measuring the volume of insoluble gas which came over. This gas was shown to burn with a blue flame, and the quantity was found in two experiments to correspond closely with the theoretical amount. The following is the composition of the oxychloride thus prepared:—

	Found.
Niobium	43·48
Chlorine	47·03
Oxygen	9·49
	100·00

A decomposition of carbon dioxide by a metallic chloride has hitherto not been observed. Phosphorus trichloride absorbs free oxygen on distillation in the air, with formation of oxychloride, but it does not decompose carbon dioxide.

"*On the Retention of Saline Impurities by Hydrated Ferric Oxide*," by Mr. Charles Frederick Cross, Dalton Scholar in the Owens College. Communicated by Prof. H. E. Roscoe, F.R.S.

It is a fact well-known to all chemists that ferric oxide, when precipitated in the form of hydrate from solutions which contain either organic matter or the fixed alkalies, carries down a certain quantity of these substances in adhesive union.

That this adhesive action is exerted upon *saline* bodies in solution, although an obvious inference, I have found nowhere stated to be the case. The importance of the analytical bearings of such a property, if it do exist, led me to undertake a quantitative investigation of the matter, the results of which I proceed briefly to detail.

I. Two grms. fine iron wire were dissolved in HCl, the solution oxidised with HNO_3, the excess of acid driven off by evaporation, distilled water added, and the volume of this solution of ferric chloride made up to about 50 c.c.

The weight of this solution was found to be 56·0955 grms. 1 grm. therefore contains 0·0356 grm. Fe as Fe_2Cl_6.

To verify this calculation: 2·529 grms. solution were precipitated by ammonia, and the iron estimated as oxide in the usual way.

	Found.	Calculated.	Difference.
Fe	0·0896	0·0901	0·0005

A series of determinations was then made in which the oxide was precipitated by ammonia in presence of sodium chloride, which was selected as a typical saline compound. The results are tabulated below:—

	Weight of Solution taken.	Weight of Fe contained.	Weight NaCl added.	Weight Fe from Fe_2O_3 obtained.	Error.
a.	2·556	0·0911	2·000	0·0938	0·0027
b.	2·574	0·0917	2·000	0·0940	0·0023
c.	2·579	0·0919	1·000	0·0945	0·0026
d.	2·542	0·0906	2·000	0·0952	0·0046
e.	2·480	0·0884	2·000	0·0941	0·0057
f.	2·587	0·0922	2·000	0·0994	0·0072

a. Wash-water 350 c.c. precipitated in *boiling* solution.
b. Wash-water 250 c.c. precipitated in *boiling* solution.
c. Wash-water 125 c.c. precipitated in *boiling* solution.
d. Wash-water 175 c.c. NaCl added after precipitation.
e. Wash-water 175 c.c. precipitated in *cold* solution.
f. Wash-water 375 c.c. precipitated in *cold* solution.

In the above determinations no more than the ordinary precautions were adopted, *i.e.*, the precipitate was washed with boiling distilled water from 15 to 30 times until the washings no longer gave an alkaline reaction.

In some cases the precipitate of oxide was re-dissolved after weighing in HCl, and the iron precipitated as sulphide. The filtrate from the latter was evaporated and the residue ignited—in every case a considerable fixed residue of sodium chloride was obtained.

A similar series of determinations was then made with ferrous ammonium sulphate; weighed quantities were oxidised with nitric acid and ferric oxide precipitated by ammonia in presence of sodium chloride. The results obtained were identical with those already cited. In two of these determinations caustic potash was substituted for ammonia: the results obtained deserve mention:—

II.—

	Weight of $Fe(NH_4)_2 2SO_4 6H_2O$.	Percentage Fe theoretical.	Weight of KOH & NaCl added. Grms.	Percentage Fe from Fe_2O_3 obtained.	Error per cent.
g.	0·706	14·28	5. KOH 5 NaCl	17·93	3·65
h.	0·720	—	—	18·76	4·48

g. Wash-water =950 c.c. precipitated in *boiling* solution.
h. Wash-water =400 c.c. precipitated in *boiling* solution.

The precipitates were re-dissolved in concentrated HCl after weighing. They were observed to effervesce violently on treatment with the acid, and on evaporating the solu-

tion the alkaline chloride crystallised out in considerable quantities.

I instance these as indicating the extent of adhesion existing between ferric oxide and the fixed alkalies, and the futility of the practice, which I believe is not unusual, of weighing a precipitate of the oxide from which alumina has been removed by means of potash, without previously re-dissolving and again precipitating.

Determinations were then made in which special precautions were taken with the view of ascertaining the limit of the error due to the retention of alkaline salt. A weighed quantity of pure iron was taken for each experiment. The results are appended :—

III.—

	Weight Fe taken.	NaCl added.	Weight Fe calculated from Fe_2O_3 obtained.	Error.
k.	0·1669	0·000	0·1666	−0·0003
l.	0·2088	1·000	0·2096	+0·0008
m.	0·1485	1·000	0·1498	+0·0013

k, *l*, *m*. Washed persistently with boiling water till washing absolutely free from chlorine.

The impurity present in the precipitate in *m* was isolated in the manner described above and weighed. It was found =0·0023 grm. Multiplying this by 0·7, the fraction expressing the ratio $Fe_2 : Fe_2O_3$, we obtain the number 0·0016, which it will be seen is in close agreement with the error obtained (calculated as Fe).

In the following experiment pure iron was brought into solution as Fe_2Cl_6, and precipitated by ammonia alone. The precipitate was thoroughly washed till the washings were absolutely free from chlorine, and transferred, together with the filter-paper, to a retort containing a solution of caustic soda, which had been freed from ammonia by prolonged boiling. The retort was connected with a condenser, the contents of the retort boiled, and the distillate "Nesslerised" in successive portions. The result is appended :—

	Weight Fe taken.	NH_3 estimated in distillate.	Calculated as NH_4Cl.
n.	0·2265	0·00054	0·0017

n. 500 c.c. boiling distilled water employed in washing the precipitate of oxide.

Determinations were then made in which other alkaline salts were substituted for sodium chloride :—

IV.—

	Weight Fe taken.	Salt added. Grm.	Weight Fe found.	Error.
p.	0·1600	LiCl. 0·25	0·1603	0·0003
q.	0·2165	Na_2SO_4	0·2191	0·0026
r.	0·2060	KNO_3	0·2097	0·0037
s.	0·1820	KNO_3	0·1866	0·0046

p. The isolated impurity was examined with the spectroscope, which showed strong Li line.
q. Washings gave H_2SO_4 reaction after all HCl removed, 500 c.c. employed.
r. Wash-water = 325 c.c. precipitate in boiling solution.
s. Wash-water = 650 c.c. precipitated in cold solution.

Having thus sufficiently investigated the adhesive action of ferric hydrate upon salts of the alkalies in solution, determinations were made in which salts of the alkaline earths were substituted for the former. For these experiments it was necessary to employ ammonia free from carbonate, which was prepared by agitating the ordinary solution with lime in a closed flask and filtering just prior to use. Care was taken to add the reagent in but very slight excess. The following results were obtained :—

V.—

	Weight Fe taken.	Salt added.	Weight Fe found.	Error.
t.	0·173	$CaCl_2$	0·1786	0·0056
v.	0·192	$CaCl_2$	0·2052	0·0132

t. Precipitated in boiling solution. Wash-water=330 c.c.
v. Precipitated in cold solution. Wash-water = 650 c.c.

Similar results were obtained in presence of barium chloride. I may mention that by employing an ordinary laboratory solution of ammonia the error on 0·152 grm. Fe (precipitated in *hot* solution) amounted to 0·0072, and on 0·2313 (precipitated in *cold* solution) to 0·0196 grm. These results were confirmed by isolating the impurities and determining the calcium by precipitation as oxalate. The precipitates effervesced considerably on treatment with the acid.

The above experiments suffice to indicate the magnitude of the obvious error which attends the common practice of separating iron and similar oxides from the alkaline earths by precipitation with excess of alkali.

Since iron is very frequently separated from other metals in the form of the basic acetate, the purity of this compound, *i.e.*, of the oxide which results from the washing and ignition of the same, was made the subject of the following determinations :—

VI.—

	Weight Fe taken.	Salt added.	Weight Fe found.	Error.
w.	0·1995	NaCl	0·2007	0·0012
x.	0·2106	NaCl	0·2122	0·0016
y.	0·1800	$CaCl_2$	0·1825	0·0025
z.	0·1987	$CaCl_2$	0·2000	0·0013

w and *x*. In all cases solution Fe_2Cl_6 nearly neutralised with $(NH_4)_2CO_3$ and precipitated by $NaC_2H_3O_2$ in excess.
y. Only a trace of Ca could be detected in the isolated impurity.

Here as before it is seen that alkaline salt is retained by the iron oxide, but the separation of the latter from the alkaline earths is practically complete.

The general conclusions to be drawn from the above results are :—

(1.) That ferric oxide, when precipitated in presence of salts of the fixed alkalies, removes a certain quantity of the latter from solutions, this quantity being within certain limits independent of the amount of alkaline salt present in solution, but varying with the temperature of the solution at the time of precipitation, being much greater in the case of cold than of hot solutions (I., IV.).

(2.) That the error due to the retention of alkaline salt may, by persistent washing with boiling water, be reduced to a minimum, but not completely eliminated (III.).

(3.) That the error is very much greater when the oxide is precipitated by excess of alkali in presence of salts of the alkaline earths; but that the latter may be effectually separated from iron by precipitating this metal in the form of the basic acetate.

(4.) That ferrous sulphide does not exert this adhesive action upon salts in solution, and is therefore, where the circumstances of the analysis permit, the best form in which to separate iron from the other metals which accompany it.

In conclusion, I would briefly call attention to the researches of Reichardt and Blumtritt* upon the adhesive action of iron oxide upon gases, as affording indirect evidence in favour of the conclusions at which I have arrived from a consideration of the results of my investigation.

The former chemist found that 100 grms. of ferric hydrate, recently prepared by precipitation with ammonia from a solution of ferric chloride, yielded under suitable conditions, 375·54 c.c. of a gaseous mixture (O, N, and CO_2); that the same weight of hydrate previously washed with hot water yielded 250·82 c.c.; and that 100 grms. of the oxide, after gentle ignition, were found to retain 40 c.c. of gas. These results, together with the composition of the gaseous mixtures in each case, is set forth in the following table :—

* *Journ. Prakt. Chem.*, ii., 440 to 467 (1866).

Weight of substance, 100 grms.

Condition of Oxide Experimented upon.	Vol. of gaseous mixture in c.c.	Ratio of vol. of substance in that of gas.	Percentage Composition of Gas by vol. N.	O.	CO_2.	Wt. of CO_2 = *i.e.*, percentage.
By precipitating Fe_2Cl_6 with NH_4OH, and drying in the air	375·54	1 : 3·00	26·29—	3·85—	69·86	0·51
After washwith hot water	250·82	1 : 3·50	18·90—	0·91—	80·19	0·39
After gentle ignition ..	42·69	1 : 0·58	65·32—	10·54—	24·14	0·02

These facts not only explain the fact of the retention of the fixed alkalies and alkaline earths in the form of carbonates, which I have stated to be the case, but compel the inference, apart from experimental verification, that the adhesive action of ferric hydrate upon saline bodies in solution would be equally characteristic.

ROYAL SOCIETY OF NEW SOUTH WALES.

Section B.—Chemistry and Geology.

A monthly meeting of this Section was held on the evening of Friday, November 16th, Prof. Liversidge in the chair.

Prof. Liversidge exhibited some interesting specimens of the siliceous and other deposits from some of the hot springs in New Zealand. He stated that he was not prepared with any paper descriptive of them, or of the geology of the localities whence they were obtained, for such would take up much more time than he could at present devote to the matter; and, moreover, such a paper would perhaps be more or less superfluous, after the many able descriptions of these springs which had been already published by various observers. He would only trouble them with a few remarks upon certain of the specimens, and would invite their attention to the series of photographs placed on the table in lieu of any description of the places.

Amongst the specimens were some samples of siliceous sinter, from a spring opposite the hotel at Ohaiawai, on the road between the Bay of Islands and Hokianga, on the west coast; also of cinnabar, from the mercurial springs near to the same place. Prof. Liversidge mentioned that he was much struck by the general similarity between the "volcanic" phenomena at Ohaiawai and those presented by the burning coal seam at Mount Wingen, the so-called "burning mountain," near to Scone —the chief differences being that the phenomena at the latter place are confined to a more limited area, and that water is absent; hence there are no hot springs or pools of warm water at Mount Wingen, as there would be if the jets of steam and heated vapour had to make their upward passage through water.

The escaping gases at both places possess very much the same general character, and deposit similar sublimates of sulphur and certain volatile salts around the vents.

At the hot mercurial springs near Ohaiawai the mercury occurs both in the native state and in the form of cinnabar. Some of the cinnabar is apparently of recent deposition, since it was observed in one place to uniformly and completely fill certain small cracks and crevices existing in the shaly rock; but the greater part of it is evidently mechanically brought to the spot by the small stream which runs down to the lake. The presence of an extensive deposit of coal, shale, or pyrites undergoing a smothered combustion or oxidation, would be quite sufficient to account for the phenomena observed at Ohaiawai and other hot springs in New Zealand,—even for the celebrated ones at Ohinemutu and at the Pink and White Terraces on the Lake Rotomahana.

Respecting the beautiful bright blue colour of the water in the basins on the Pink and White Terraces at Rotomahana, a blue so extraordinarily beautiful that travellers are unable to find words to express their admiration for it, Prof. Liversidge explained that the blue colour was due to the reflection of the light from the innumerable minute particles of silica suspended in the water—just as the pale sky-blue colour of a mixture of milk and water is caused by the reflection of the light from the minute fat globules suspended in it. He was also inclined to attribute the equally beautiful blue colour of the lower layers of steam floating over the surface of the boiling waters to a similar cause, for he had but little doubt that the escaping steam bears minute particles of silica with it in its upward course.

The colour of the steam does not appear to be due to a reflection of the colour of the water below it, any more than the colour of the water in the basin is due to a reflection of the sky.

The beautiful opalescent blue of the water in the basin is very different in appearance from the clear, but equally magnificent, purple-blue of one of *ngwahas*, or boiling springs, near Ohinemutu. This latter blue water is remarkably transparent, and one can see down through it to very great depths, but the Terrace water is rendered too turbid by the silica in suspension for the eye to penetrate far down into it.

Part of the silica brought up by the water is thrown down as a soft pulverulent deposit at the bottom of the basins, while another portion is more slowly precipitated as a hard and smooth stony material, known as siliceous sinter or geysirite, and it is of this that the terraces and basins are built up; so rapidly is this deposited that leaves and twigs become quickly invested, and it is stated that even dead birds become coated with it before the animal matter has time to decay and fall to pieces.

The pink colour of the Pink terrace is apparently due to the entanglement by the asperities on the stalactitic faces of the terraces of small quantities of red clay brought down by the water.

A specimen of recently-formed iron pyrites, which had been taken from a mass now forming upon some dead twigs in one of the hot springs (Jack Loffley's, the Taupo guide) at Lake Taupo, was also shown. On examination, this mass of mixed newly-formed pyrites and dead vegetable matter was found to contain traces of gold.

AKADEMIE DER WISSENSCHAFTEN, VIENNA.

November, 1877.

L. Pfaundler, "*Smallest Absolute Number of Vibrations necessary to yield a Tone.*" Experiments on a siren with two openings show that two isolated acoustic vibrations are capable of producing a tone, which alone is not sensible, but on repetition can be heard.

E. Secher, "*Specific Heat of Mixtures of Methyl-Alcohol and Water.*" Some of these mixtures are found to possess a greater specific heat than water or dilute ethyl-alcohol, and to be surpassed in this respect by hydrogen only, amongst known bodies.

F. v. Höhnel, *Investigations on Cork, Xylophilin, and Coniferin.* The suberin which forms the chief constituent of cork is found to be a well-defined substance, capable of building up membranes, insoluble in alcohol, characterised by reactions with potassium, nitro-acid, and chromic acid, and containing 74 per cent C and 10 per cent H, with no N. The violet colouration often yielded by woody tissues in contact with HCl results from the presence of xylophin, a colourless substance, soluble in water and alcohol, which is found in about 60 per cent of the various woods. Coniferin seems to be present in small quantities as a constant companion of lignin, and its intense blue-green reaction with phenol and HCl can be used as a test for lignin.

CORRESPONDENCE.

THE INSTITUTE OF CHEMISTRY.

To the Editor of the Chemical News.

Sir,—Observing that, at the eleventh hour, some of the professional chemists of Britain are awakening to a sense of the injury that is being attempted to be done to them under the guise of "organisation," I ask you to spare me a corner for a short explanation of my action in the matter, which I regret to say has been misrepresented by certain interested parties.

I have never for a moment objected to, and indeed would cordially support, any fair attempt at universal organisation; but when I ascertained that a certain number of the friends of the promoters of the present scheme had met together by invitation, and decided to form themselves into a limited company to choose whom they should, or should not, declare competent, by electing them members of their Institute, I felt so strongly the danger of such a proceeding to the mass of professional chemists throughout the country that I forthwith entered at the Board of Trade a protest against the registration. I will not here give a copy of that protest, with all its tedious legal phraseology, but simply say that in it I urged two points:—

1. That, looking to the rights of existing chemists in practice, no such organisation should be permitted, unless it started on the distinct basis of at once admitting every practising chemist in Britain, at the date of its formation. In support of this view I quoted the existing legal organisations of the medical and pharmaceutical professions, both of which were distinctly started on that fair and honest footing, and I pointed out the injury likely to result if A, an analyst in some place who knew a promoter, could get himself invited, and then quietly deposit his black ball against his opponent B, in the same town.
2. That no body of men should be granted any registration unless they were themselves really and truly practising professional chemists. Under this head I pointed out that the self-elected nucleus contained many persons—such as purely Government servants, pharmacists, and *dilettanti*—who did not come under the category of real professional chemists, earning a living by their business, and that it would be grossly unjust that such men should sit in judgment to select competent persons to be honoured by their new qualification.

To this the Board of Trade, after a long consideration, replied that they had no legal power to refuse registration, but that if I and the others who held my views chose to form a company they would register us on the same footing.

Having thus explained the grounds of my (as I venture to submit) most reasonable opposition to the present scheme, I would earnestly ask the professional chemists of England to pause and consider before they consent to humble themselves by submitting to the vote of the present directors of this limited company. If, on consideration, they think as I do, the thing will simply die a natural death, and those whose vanity has been tickled by being invited as truly competent men, and who have therefore accepted blindfolded, will find that all they get in return is simply the loss of their entrance-money and a future contribution towards the winding-up of the company in Chancery.

If the present company wish a real success, let them adopt the only just and legal method of organisation, as above sketched, and give up the secret elections and marked favouritism which has hitherto distinguished them.—I am, &c.,

John Muter.

South London Central Laboratory, Kennington Cross,
January 14, 1878.

THE INSTITUTE OF CHEMISTRY.

To the Editor of the Chemical News.

Sir,—In your issue of the 4th (Chem. News, vol. xxxvii., p. 8), a letter relating to the above Institute appeared, signed "Well-wisher," and dated December 26th, with most of which I cordially agree. There are, however, some inaccuracies in it, or rather expressions which may tend to produce erroneous impressions, as for instance "that the whole organisation has been arranged by a council of chemists in London." It is true that the *meetings* were held in London; but of the forty-nine chemists composing the original committee sixteen were country members, residing in various parts of the United Kingdom—for it was one of the chief objects of the promoters to render this organisation committee as representative as possible, not only in special departments of chemistry, but also with reference to all the great centres of manufacturing industry and scientific education.

Although I cannot ask for space to give, as your correspondent suggests, "very full information" in reference to the Institute, seeing that the Memorandum and Articles of Association, containing an account of the qualifications required of candidates for admission as Fellows or Associates, and Rules for the regulation of the Society, form a pamphlet of some twenty-four closely-printed pages; yet there are one or two points in connection with the Institute which may interest your readers, and which can be very briefly stated.

1. The officers and other members of the present Council, who were naturally selected almost entirely from the members of the organisation committee, are as follows:—

President—Dr. Frankland.
Vice-Presidents—Prof. F. A. Abel, Dr. A. Crum-Brown, Prof. R. Galloway, Dr. W. Odling, Dr. R. A. Smith, and Dr. A. Voelcker.
Treasurer—Dr. C. R. A. Wright.
Other Members of Council—Dr. Attfield, Messrs. J. Bell, D. Campbell, M. Carteighe, W. Crookes, and G. E. Davis, Dr. W. De la Rue, Prof. Dittmar, Dr. Dupré, Mr. R. J. Friswell, Dr. Gladstone, Messrs. G. Gore, W. N. Hartley, D. Herman, D. Howard, and C. T. Kingzett, Prof. Marreco, Mr. F. A. Manning, Dr. E. J. Mills, Messrs. E. Neison and J. Pattinson, Dr. Redwood, Prof. J. Emerson Reynolds, Dr. T. Stevenson, Mr. R. R. Tatlock, Prof. R. V. Tuson, and Mr. T. Way.

2. The objects for which the Association is established are—To promote and encourage a thorough study of Chemistry and all branches of Science allied thereto, in their application to the Arts, to Agriculture, to Public Health, and to Technical Industry, and to adopt such measures as may be necessary for the advancement of the profession of Chemistry, and particularly for the maintenance of the profession of the consulting and analytical chemist on a sound and satisfactory basis.

Information as to the constitution of the Institute, powers of council, qualifications for admission, fees, &c., may be obtained from the Secretary, as stated in the Advertisement, which appeared in the Chemical News of December 28th and in subsequent numbers, so that if "Well-wisher" desires to be admitted to the Institute, and will send me his name and address, I shall be very happy to forward him a copy of the articles and any other information in my power.—I am, &c.

Charles E. Groves,
Secretary to the Institute.

Somerset House Terrace, W.C.

THE INSTITUTE OF CHEMISTRY.

To the Editor of the Chemical News.

Sir,—As Solicitor to the Institute of Chemistry you will allow me to reply to your correspondent "Nemo me impune lacessit" (Chem. News, vol. xxxvii., p. 19).

Although the Institute has been registered under a special provision of the Companies Act, 1867, inserted in that Act for the special purpose of meeting a case like that of the Institute, it is not the fact—as suggested by your correspondent—that the Institute has been registered as a "limited liability" company, in the sense in which that expression is generally used.

By availing themselves of this special provision of the Act of Parliament the founders of the Institute have secured the advantages of legal incorporation, whereby the Institute secures the right of perpetual existence, a constitution elastic and capable of being adapted to the proved and ever-changing requirements of the body of 'professional chemists," and due provision against liability on the part of its individual members.

The objects for which the Institute was established, as stated in the Memorandum of Association and sanctioned by the Board of Trade, after reference had been made by the Board to the Privy Council, the Pharmaceutical Society, and Dr. Greenhow, are as follows:—

"(A.) To promote and encourage a thorough study of Chemistry, and all branches of Science allied thereto, in their application to the Arts, to Agriculture, to Public Health, and to Technical Industry.

"(B.) To adopt such measures as may be necessary for the advancement of the profession of Chemistry, and particularly for the maintenance of the profession of the consulting and analytical chemist, on a sound and satisfactory basis.

"(C.) The doing of all such other lawful things as are incidental or conducive to the attainment of the above objects."

And the condition on which the Board of Trade granted a license for the registration of the Institute under the provision of the Act to which reference has already been made, and which is set out in the Memorandum of Association, requires the whole income and property of the Institute, whencesoever derived, to be applied solely towards the promotion of the above objects, and prohibits any portion thereof being paid or transferred directly or indirectly by way of dividend or bonus, or otherwise howsoever, by way of profit to any persons who are or have been members of the Institute; but there is a saving clause which permits payments, when made in good faith, of remuneration to any professors, examiners, lecturers, tutors, secretary, or other officers or servants of the Institute, or other person, in return for any services actually rendered, or goods or other property sold, to the Institute.

The violation of this condition renders unlimited the liability of every member of the council; and the liability of every member of the Institute who has received any such dividend, bonus, or profit, is in such case likewise unlimited; but in every other case (in the event of the Institute being wound up) the liability of each person who is then a member of the Institute (or who was a member at any time within twelve months previously to the winding up) to pay the debts and liabilities of the Institute is limited to a sum not to exceed £5.

The extent of a member's liability is this sum of £5, and this sum has only to be paid in the case of the Institute being dissolved and its assets proving insufficient to pay its debts. Having regard to the character of the men forming the Council and the number of persons who are joining the Institute, there is a prospect of the most abundant success, and no danger of a failure of the scheme. No person need therefore fear the liability resting upon him when he becomes a member of the Institute.—I am, &c.,

J. Pettengill.

32, Walbrook, London,
January 16, 1878.

BUTTER ANALYSIS.

To the Editor of the Chemical News.

Sir,—Whether the name "Stopcock Flask" or "Separating Funnel" be applied to the apparatus I figured is of little moment: as, however, it is made by letting a stopcock into the bottom of a flask, I prefer the name that I gave it.

I am quite aware that "the idea of separating fatty acids in a flask is not new," as it was proposed by Dr. Muter long ago, but, having had more than a year's experience of the method I described, I have found that it is simple and expeditious. I preferred waiting until I had satisfied myself that by means of it all the difficulties in the estimation of the insoluble fatty acids had been got rid of.

It will be found that the solution of the cake of acids in ether, and the separation of all water in the way described, much facilitates the drying, and I think that the "stopcock flask" will be found to offer considerable practical advantages for this part of the process, while the transference of the soap from the saponifying flask to the stopcock flask—if conducted in the manner suggested—is at most a trifling disadvantage.

I leave it to those who have to make butter analyses to find out whether they prefer this plan or the one described by Mr. Wynter Blyth.—I am, &c.,

W. H. Corfield, M.A., M.D. (Oxon).

University College,
January 16, 1878.

AMMONIA IN FILTERED WATER.

To the Editor of the Chemical News.

Sir,—I have read the two letters (Chem. News, vol. xxxvii. p. 19), replying to my communication of the 4th instant, and I wish now to state that the water *before* filtration was found to be practically free from nitrates or nitrites, and I ought to have stated this before. Had these salts been present my wonder would have ceased.—I am, &c.,

Geo. Jones.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale.

No. 48, December, 1877.

Report presented by M. Lamy on behalf of the Committee of Chemical Arts on a Memoir entitled "Manufacture of Sugar Candy," by M. Flourens.—The manufacture of sugar candy is said to be of considerable importance at Nantes, in the north of France, and in Belgium. M. Flourens has drawn up tables showing the amount of saccharine matter in saturated solutions from 0° to 100° with the corresponding degrees of the areometer and densimeter, the density and the areometric degree of the same solutions at the temperature of 15°, and the boiling-point of these solutions at different degrees of concentration.

Studies on Nitro-glycerin and Dynamite.—A. Brull (Continuation).—A prolonged treatise quite incapable of useful abstraction.

Origin of Natural Amber and on the Characters by which it is distinguished from Artificial Amber.—M. Rehoux.—The author mentions two principal localities where amber occurs; Sicily, whence the chief supply was obtained in antiquity, and the coasts of the Baltic, where it appears to consist chiefly of the fossilised resin of an extinct conifer, *Pinus succinus*. The production of amber in 1874 amounted to 1874 kilos. Amber may be distinguished from artificial amber and from every substance having any physical analogy with it, especially copal, by the following characters:—Copal is yellow, more or less deep, but always unicolorous; it has on its surface some yellow points like crystallised sulphur. Amber, on the contrary, has always one end of a different shade from the other. If a sample is rubbed for a few seconds upon the palm of the hand near the little finger, if it exhales a strong aromatic odour, it is amber, for neither copal nor artificial amber has any odour. On prolonged exposure to the air amber sometimes loses its essential oil and its characteristic aspect. If copal is scraped with the blade of a knife a fine dust is given off, which rises in the air. If amber is scraped the raspings fall downwards. If amber is gently heated at the flame of a candle it may be bent, whilst artificial amber and copal are inflexible under the same circumstances. Natural amber resists pressure with the nails, whilst factitious amber and copal are indented. Copal melts at 100°, and when liquefied preserves its yellow colour. Amber does not melt below 400°; it blackens and gives off a very distinct odour of sulphuretted hydrogen. Its specific gravity is 1·09 to 1·11, that of copal being 1·04, and that of artificial amber 1·05. Yellow amber, according to Schrötter, is composed of:

Carbon	78·82
Hydrogen	10·23
Oxygen	10·90
	99·95

—*Annales de Chimie.*

Journal für Praktische Chemie.
No. 16, 1877.

Plato-nitrites and Diplato-nitrites.—L. F. Nilson.—The author describes with great exactness and completeness nearly the entire series of metallic salts with the so-called plato-nitrosylic acid, $H_2.4NO_2.Pt$ (see Chemical News, xxxiv., 270), formerly considered as acid platinous nitrite. The crystalline properties of these compounds are surpassed by but few series of salts. With a number of bases, such as Fe_2O_3,HgO, &c., diplato-nitrites are formed of the general formula $Ag_2.4NO_2.Pt_2O$.

The Warm Springs of Asmannshausen.—R. Fresenius.—The water from these springs is found to contain 1000 parts 0·0278 parts of bicarbonate of lithium, a percentage which places it foremost in the list of alkaline springs containing appreciable amounts of the salts of this rare metal.

Quantitative Spectral Analysis, and a New Spectro-photometer.—G. Hüfner.—The author has prepared a somewhat complicated apparatus for the application of the spectroscope to quantitative analysis, based on the most elaborate physical and physiological observations. The essential principle is the use of a Nicol's prism, through which passes a ray of light which has traversed the medium to be analysed. The arrangement allows of the comparison of this ray with one passing through a normal solution, and by revolving the prism the light of the brighter ray is reduced to the same degree as that of its companion. The angle described by the revolving prism gives, then, the difference in the two liquids, which are placed otherwise under the same conditions as to quantity, source of light, &c. Experiments showed a probable error of 0·83 per cent in the various determinations.

Separation of Media Free from Oxygen.—F. W. Gunning.—Pasteur and other chemists claim that they have observed the ability of certain kinds of bacteria to exist and manifest activity by a complete absence of oxygen. The question has been raised as to the completeness of the exclusion of oxygen, and the author first shows that the absence of a phosphoresce when phosphorus is introduced into a gas does not prove the absence of oxygen. This is done by the use of a much more sensitive reagent, namely, the precipitate obtained on combining ferrocyanide of potassium and a ferrous salt, which when pure is perfectly white, and becomes blue only in contact with oxygen. The experiments showed, likewise, that it was impossible to free an apparatus from oxygen simply by absorption with P. The use of the new reagent has also made manifest that it is impossible to prepare atmospheres of H, CO_2, or even H_2S and SO_2, entirely free from O by the customary methods. The best reagent for the absorption of O is ascertained to be a mixture of a solution of ferrous salt with an excess of HNaO or with grape-sugar. The precipitate from the ferrocyanide remains perfectly white in an apparatus containing this solution.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 14, Deeember 6, 1877.

Aroma of Butter.—Many butters, especially those made in winter, are devoid of aroma. To remedy this evil a Silesian farmer keeps suspended in his churn, when empty and closed, a calico bag containing white and yellow melilot, queen of the meadow (*Asperula odorata*), and other odoriferous meadow herbs. When the cream is to be churned four smaller bags of the same materials are fastened to the arms of the churn. In this manner butters possessing the aroma of mountain growths may be produced.

No. 15, December 12, 1877.

Telluric Theory of Cholera.—MM. Pettenkofer and Decaisne conclude that cholera occurs upon all geological formations, but its development and propagation are affected by the physical aggregation of the soil, its permeability for water and for air, and the variable quantity of water which it contains. The disease prefers, not merely certain quarters in the locality, but also certain regions in the country, avoiding others. On board ship as a rule cholera does not spread. The upholders of the telluric theory have always admitted a specific infectious matter, a cholera germ, which is propagated by human communication, but not by the free air at great distances.

No. 16, December 20, 1877.

M. Gramme, the inventor of the well known continuous-current magneto-electric machine, has been nominated a chevalier of the Legion of Honour.

M. Trouvé has succeeded in passing the sound of a repeater when it strikes the hour through a resistance equal to 3000 kilometres of distance.

The entire stock of one of the most important dealers in wines, specially intended for pharmaceutical purposes, has been seized as being entirely compounded of spirit of wine and sugar, flavoured with different herbs.

A bee-keeper, writing to the *Journal du Loiret*, foretells a mild winter, since the bees have not closed the entrances to the hives with wax, as he has observed them do when a hard winter is at hand.

Under the heading "New Application of Dynamite," we are told that it has been employed in the United States felling trees. Where we should expect a description of the process follow these words:—"A voltaic

battery is taken and the two poles are connected with a platinum wire heated to whiteness. The wire is laid against the tree and contact is made. The wire passes across the wood and burns it rapidly. Thus a tree which the most skilful woodman could not fell in three or four hours is cut in two in a quarter of an hour." Where is the dynamite?

M. Mure, of Bourg, St. Andeol, asserts that the Jablochkoff battery, in which charcoal takes the place of zinc, is not novel.

Myopism and Civilisation.—Dr. Loring finds that shortsightedness is greatly on the increase. On 2265 scholars in the public schools of New York, sound vision was found in 87 per cent of those under seven years of age, but between the ages of seven and twenty-one only in 61 per cent. Among the causes he ranks, not merely excessive study, but a sedentary life, insufficient nutrition, bad air, and general absence of hygienic precautions. Microscopic work affects the eyes less at a tolerably advanced age than when taken up in youth.

MISCELLANEOUS.

University of Durham.—James Murphy, B.A., M.D., has been appointed to the Chair of Botany at the University of Durham College of Medicine, at Newcastle-on-Tyne.

The Use of Maté in Europe.—According to the *Allgemeine Chemiker Zeitung* "Paraguay tea" has been introduced into Austria, where it is strongly recommended by Prof. Kletzinsky as a dietetically happy combination of caffein and tannin, and as the most salutary of all beverages of this class. Our contemporary continues—"Far be it from us to contradict Prof. Kletzinsky, although when we exert our memory we find the name Kletzinsky everywhere when it is required to set a proprietary article, such as a hair-dye, a pomade, &c., upon its feet; and thus the name is apt to make us shudder." Might we not almost say—

——— "mutato nomine de . . .
Fabula narratur?"

Disinfecting Properties of Cellulosic Substances Carbonised with Concentrated Sulphuric Acid.—F. Garcin.—Wood, paper, rags, &c., if plunged for a few moments into concentrated sulphuric acid, are transformed into a black substance, which is not pure carbon, but retains hydrogen, and approaches the humic products, and possesses a remarkable absorbing and disinfecting power.—*Comptes Rendus.*

MEETINGS FOR THE WEEK.

MONDAY, 21st.—Medical, 8.
—— London Institution, 5.
TUESDAY 22nd.—Civil Engineers, 8.
—— Anthropological, 8.
—— Royal Institution, 3. "Protoplasmic Theory of Life, and its Bearing on Physiology," Professor Garrod.
WEDNESDAY, 23rd.—Society of Arts, 8.
—— Geological, 8.
THURSDAY, 24th.—London Institution, 7.
—— Royal, 8.30.
—— Royal Institution, 3. "Chemistry of the Organic World," Prof. Dewar.
FRIDAY, 25th.—Quekett Club, 8.
—— Royal Institution, 8. Weekly Meeting. "On William Harvey," Prof. Huxley, 9.
SATURDAY, 26th.—Royal Institution, 3. "Carthage and the Carthaginians," R. Bosworth Smith, M.A.

TO CORRESPONDENTS.

C. H. Parkin.—Fownes's "Chemistry," Bloxam's "Laboratory Teaching," Roscoe's "Chemistry."

Erratum.—In Vol. xxxvi., p. 281, the article on the "Sale of Food and Drugs Act for Germany" should have been acknowledged from advance sheets of *The Analyst.*

GANOT'S PHYSICS AND NATURAL PHILOSOPHY.

In crown 8vo., with Coloured Plate and 464 Woodcuts, 7s. 6d.

NATURAL PHILOSOPHY for GENERAL READERS and YOUNG PERSONS, translated from the French of E. GANOT (with the Author's sanction) by E. ATKINSON, Ph.D., F.C.S., Professor of Experimental Science, Staff College. Third Edition, newly revised.

By the same Translator, in large crown 8vo., price 15s.

GANOT'S ELEMENTARY TREATISE on PHYSICS, Experimental and Applied, for the use of Colleges and Schools. Eighth Edition, revised and enlarged, with 4 Coloured Plates and 820 Woodcuts

In the present edition no other change has been made in the body of the work than a slight alteration of the size of the page, which, with the addition of some fresh matter, has increased by about sixty pages the size of the book as it stood in the Seventh Edition. The new matter includes sixty-two additional illustrations.

London: LONGMANS and CO.

Now ready, 8vo., cloth, 30s.

PHOTOGRAPHED SPECTRA. One Hundred and Thirty-six Photographs of Metallic, Gaseous, and other Spectra, printed by the permanent autotype process, with Introduction, Description of Plates, and Index; and with an extra plate of the Solar Spectrum (showing bright lines), compared with the Air Spectrum, by J. RAND CAPRON, F.R.A.S.

London: E. and F. N. SPON, 46, Charing Cross.
New York: 446, Broome Street.

ROYAL INSTITUTION OF GREAT BRITAIN
ALBEMARLE STREET PICCADILLY, W.

ARRANGEMENTS FOR NEXT WEEK.

HOUR, THREE o'CLOCK.

Professor ALFRED H. GARROD, M.A., F.R.S.—Twelve Lectures on the Protoplasmic Theory of Life, and its Bearing on Physiology; beginning on Tuesday next, Jan. 22.

JAMES DEWAR, Esq., M.A., F.R.S.—Twelve Lectures on the Chemistry of the Organic World: on Thursday next, Jan. 24.

R. BOSWORTH SMITH, Esq., M.A.—Seven Lectures on Carthage and the Carthaginians; on Saturday next, Jan. 26.

Subscription to all the Courses in the Season, Two Guineas; to a Single Course, according to length, One Guinea, or Half-a-Guinea.

Tickets now issued daily.

The Friday Evening Meetings will begin on January 25th, at 8 p.m., when Professor Huxley will give a Discourse at 9 p.m., on William Harvey.—Professor Tyndall will probably give the Discourse on March 22.

Borough of NEWPORT, MONMOUTHSHIRE.

SALE OF FOOD AND DRUGS ACT, 1875.

This Corporation is desirous of receiving Applications from Gentlemen competent to act as PUBLIC ANALYST for this Borough.

Applications, stating Terms and accompanied by Testimonials, are to be sent to my Office, endorsed "Public Analyst," not later than Monday, the 28th instant, and the Appointment will be made subject to the approval of the Local Government Board.

THOS. WOOLLETT,
January 14, 1878. *Town Clerk.*

Chemical Manufactory (Old Established) in Glamorganshire.

ACETATE SODA, NAPHTHA, and CHARCOAL WORKS for SALE, as a going concern. Capital required about £2500, part of which, if desired, may remain on the property. The supply of water is abundant. Favourably situated for wood, near railway stations; in the midst of charcoal consumers.—Address, A. B. C., 163, Junction Road, London.

ROYAL POLYTECHNIC.—CHRISTMAS HOLIDAY PROGRAMME.—THE ROSE AND THE RING: A Christmas Fairy Tale, adapted from Thackeray; given by Mr. Seymour Smith, vocally assisted by Misses Lotti Verona, Marion Vere, Minnie Clifford, &c.—CHEMICAL MYSTERIES, a Holiday Lecture; and LIGHT AND COLOUR, with Interesting Experiments by Professor Gardner.—PRESTIDIGITATION Extraordinary, by Dr. Holden.—THE RUSSO-TURKISH WAR, its History and Progress to the present date; and a lecture illustrative o TORPEDO WARFARE, with an Interesting Exhibition of Torpedoes, by Mr. J. L. King.—CHRISTMAS IN THE OLDEN TIME, Merry Shadows, &c. Admission to the whole, 1s.; Reserved Stalls, 2s. 6d. Tickets can be sent by post. Annual Tickets, available till December 31st, 1878, 10s. 6d.

THE CHEMICAL NEWS.

Vol. XXXVII. No. 948.

ON DYER'S CHEMICALS.

By J. MARZELL.

In consequence of the very low prices to which an over-production has made the tar-products sink to, it might be of interest to many a manufacturer to learn something of the way of working up the crude products to articles of a better market-value.

The far greater portion of the tar-products being used for the artificial dyes, it is the manufacturing of the intermediate articles required in that branch which is of main interest; and it is a strange fact that the so-called dyer's chemicals, having a good market in England itself, are nearly all imported from the Continent, whilst a great part of the English crude products go abroad.

Let us, then, consider the various ways of working them up to their derivatives.

A. *Benzol and its Derivatives.*
- Pure benzol.
- Resorcin.
- Methyl-aniline.
- Dinitro-benzol.
- β-Phenylen-diamin.
- Diphenylamin, and its alcoholic derivatives.

B. *Phenol (Carbolic Acid).*
- Manipulation.
- Purifying.
- Picric Acid.

C. *Naphthalin.*
- Manipulation.
- Purifying.
- Naphthylamin.
- Naphthol.
- Phthalic acid.
- Benzoic acid.

D. *Anthracen.*
- Manipulation.
- Purifying. { Washing. Subliming.
- Anthraquinon.

A. Benzol Derivatives.

Pure Benzol.

The base and starting-point for all these articles is a good pure benzol, and it is imperative—so as not to spoil all the work from beginning—that its extreme boiling-points do not vary more than 2° to 3° C.; a benzol going over between 82° to 84° C. (middle temperature) being sufficient.

Referring to the manufacture on a large scale of such a pure benzol, it rests upon fractional distillation; that is to say, on separating the different bodies according to their boiling-points, by carefully working with the refluxing condenser.

Following these principles Mansfield had already constructed an apparatus in 1847, but this was more fitted for the laboratory than for the industry.

In 1860 E. Kopp recommended the use of the column-apparatus employed in rectifying spirit, and in 1863 A. Coupier introduced the same into the practice, with only a few modifications.

The apparatus itself and its working are thoroughly described in Muspratt's new edition, and therefore elaborate detail is not necessary.

Notwithstanding its simplicity the apparatus requires very careful observation as to the heights of the thermometers, pressure of steam, &c.

The refrigerating liquid (reflux condenser) generally consists of a solution of chloride of calcium, which, in case the obtaining of xylol and cumol is wanted, must be replaced by paraffin or a saturated solution of nitrate of ammonia, not boiling below 164° C. To bring it to that temperature it must be subjected to a pressure of steam of 5 to 6 atmospheres.

The following are some data connected with the process:—

To obtain—	Temperature of the Reflux Bath.	Pressure of Steam in the Still.
Benzol	60° to 70° C.	2½ atmospheres.
Toluol	100 ,, 105 ,,	3½ ,,
Xylol	130 ,, 135 ,,	4½ ,,
Cumol	160 ,, 163 ,,	5 to 6 ,,

Referring to the proportions for chloride of calcium baths, the following practical notes may be useful:—

Solution of 50 $CaCl_2$ in 100 H_2O boils at 112° C.
,, 100 ,, 100 ,, ,, 128 ,,
,, 200 ,, 100 ,, ,, 158 ,,
,, 325 ,, 100 ,, ,, 180 ,,

According to M. Coupier, the yield of a benzol (100 litres) boiling between 80° and 150° C. would be as follows:—

	Litres.	Boiling at—
Mixture (benzol and lower boiling products	6	62° to 80° C.
Benzol	44	80 ,, 82 ,,
Mixture (benzol and toluol).. ..	6	82 ,, 110 ,,
Toluol	17	110 ,, 112 ,,
Mixture (toluol and xylol)	5	112 ,, 137 ,,
Xylol	9	137 ,, 140 ,,
Mixture (xylol and higher boiling products)	5	140 ,, 148 ,,
?	8	148 ,, 150 ,,
	100	

These numbers can be represented graphically by the accompanying diagram.

Naturally a good market product (say 90 per cent benzol) has to be taken to start with.

Resorcin, $C_6H_4(OH)_2$.

When the discovery* and industrious realisation† of eosin rendered the manufacturing of resorcin necessary, the old method—dry distillation of Fernambuk extract, &c.,—had to be discarded, and, according to the constitution of the body, benzol and phenol were taken for crude materials.

The resorcin is a dioxy-benzol or mono-xyphenol, the two hydroxyls assuming the meta (1·3) place in the benzol ring.

Oppenheim and Vogt‡ treated benzol with chlorine and iodine, and converted the so-obtained chlor-benzol into mono-chlor-benzol-sulpho acid, the soda-salt of which they melted, observing some precautions, with twice the quantity of caustic soda,—

$$C_6H_4\begin{Bmatrix}Cl\\SO_3\end{Bmatrix}Na+\begin{Bmatrix}NaOH\\NaOH\end{Bmatrix}=NaCl+Na_2SO_3+$$
$$+C_6H_4\begin{Bmatrix}OH & 1.\\OH & 3.\end{Bmatrix}$$

They got a resorcin of b. p. 104° C.

According to Faust‖ there is comparatively much resorcin formed by melting chlor-phenol,—

$$\left(C_6H_4\begin{Bmatrix}OH\\Cl\end{Bmatrix}\right),$$

* Bayer and Caro, *Berichte der Deutsch. Chem. Gesell.*, viii., 147. *Moniteur Scientifique* (3), v., 395. A. W. Hofmann, *Berichte der Deutsch. Chem. Gesell.*, viii., 62. *Moniteur Scientifique* (3), v., 291.

† Bindschädler and Busch, *Mon. Scient.* (3), v., 974. M. L. Durand, *Mon. Scient.* (3), vii., 696.

‡ *Zeitschrift für Chemie*, 1868, p. 722.

‖ *Berichte der Deutsch. Chem. Gesell.*, 1873, p. 1022

of b. p. 218° C., with caustic potassa,—

$$C_6H_4\left\{\begin{matrix}OH\\Cl\end{matrix}\right\}+KOH=KCl+C_6H_4\left\{\begin{matrix}OH & 1.\\OH & 3.\end{matrix}\right.$$

whilst Petersen and Bähr-Bredari* only got hydrochinon (the isomer with the hydroxyls in 1·4) in that way.

C. Wurster and E. Nölting† converted brom-nitro-benzol,—

$$\left(C_6H_4\left\{\begin{matrix}Br\\NO_2\end{matrix}\right.\right),$$

of b. p. 56° C. (obtained from brom-nitro-amido-benzol, Wurster‡) by reduction with tin and hydrochloric acid into a brom-anilin,—

$$\left(C_6H_4\left\{\begin{matrix}Br\\NH_2\end{matrix}\right.\right),$$

of b. p. 241·5° C. By means of the diazo-derivative they get a brom-phenol,—

$$\left(C_6H_4\left\{\begin{matrix}OH\\Br\end{matrix}\right.\right),$$

of 227° to 229° C. b. p., which, by melting with caustic soda, yields a resorcin of b. p. 102° C.

R. Fittig and E. Mager‖ obtained large quantities of resorcin by melting para-brom-phenol with caustic soda and a little water, at a low temperature.

According to E. Nölting and Wrzesinski,§ para-iod-phenol—yielding hydrochinon at 165° C.—is converted into resorcin at a higher temperature when melted with caustic soda.

Egli¶ produces benzol-disulpho acid by treating sulphuric acid, heated up to 240° C., with vapours of benzol, and gets resorcin by melting the soda-salt of the same with caustic soda,—

$$C_6H_4\left\{\begin{matrix}SO_3Na\\SO_3Na\end{matrix}\right.+\left\{\begin{matrix}NaOH\\NaOH\end{matrix}\right.=2SO_3Na_2+C_6H_4\left\{\begin{matrix}OH.\\OH.\end{matrix}\right.$$

For the manufacture on a large scale only two ways seem to be of interest:—

1. Diluting halogen-derivatives of benzol—either chlorine or bromine—in fuming sulphuric acid, and baking the soda-salt of the resulting chlor-benzol-sulpho acid with caustic soda.
2. Benzol-disulpho acid, obtained by treating sulphuric acid at a certain temperature with benzol vapours, is converted into its soda-salt, and baked with caustic soda.

A very intelligible way is the following:—Heating up a solution of phenol in concentrated sulphuric acid, the ortho-phenol-sulpho acid first formed will be converted into the meta modification, the soda-salt of which ought to give resorcin by baking with caustic soda.* But the researches of Kekulé† and Zincke‡ in that direction have not been successful.

* *Zeitschrift für Chemie*, 1870, p. 246.
† *Berichte der Deutsch. Chem. Gesell.*, 1874, p. 904.
‡ *Ibid.*, 1873, p. 1542.
‖ *Ibid.*, 1874, p. 1177.
§ *Ibid.*, 1875, p. 820.
¶ *Ibid.*, viii., 871. *Moniteur Scientifique* (3), v., 974.

Manufacturing Process.

Concentrated sulphuric acid, 1·843 sp. gr. (4 parts of weight) is treated with benzol vapours (1 part of weight) at a certain temperature—according to M. L. Durand at 240° C.

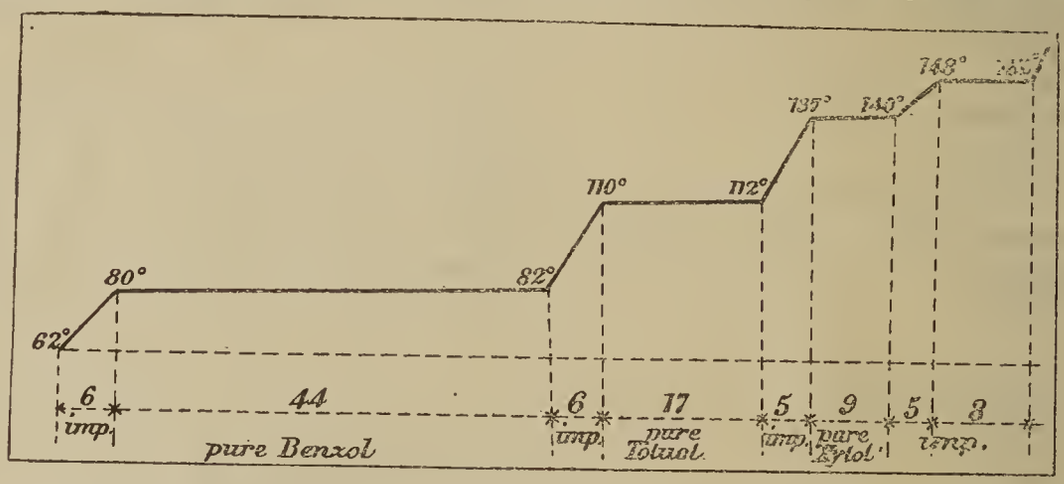
The apparatus containing the sulphuric acid is fitted, besides the inlet-pipe, &c., with an outlet ending in a condenser, which collects the unabsorbed benzol. The condensed product is pumped back into the benzol-still.

The operation finished, the whole is put into ten times its volume of water, and neutralised with lime.

The quantity of lime necessary for neutralising can be calculated from the sulphuric acid used. In a wooden vessel, fitted either with a wooden agitator or a steam-injector, the lime is converted into a thin milk of lime, and then the melt added. The agitator is moving all the time.

The free sulphuric acid forms insoluble sulphate of lime, which precipitates, whilst the lime-salt of the benzol-disulpho acid remains in solution.

By pumping through filter-presses the sulphate of lime



is separated; but the mass containing a quantity o sulpho-salt ought to be washed carefully, which is effected with little difficulty if the presses are provided with a washing apparatus.

As to the filter-presses themselves, it is best to take such as have iron plates, and are proved for high pressure.

The liquor, containing the lime-salt of the benzol-bisulpho acid,—

$$(C_6H_4<\begin{matrix}SO_3\\SO_3\end{matrix}>Ca),$$

is heated up, and treated with carbonate of soda till a sample does not show any precipitate on addition of more Na_2CO_3.

$$C_6H_4\left\{\begin{matrix}SO_3\\SO_3\end{matrix}\right.Ca+Na_2CO_3=C_6H_4\left\{\begin{matrix}SO_3Na\\SO_3Na\end{matrix}\right.+CaCO_3.$$

As evaporating pans open vessels can be used, even with a steam jacket or a system of steam-pipes laid on the bottom.

The resulting precipitate of carbonate of lime is separated by filter-pressing, and the filtrate evaporated down to dryness, the resulting residue, of a light hue, representing the sodium-salt,—

$$C_6H_4\left\{\begin{matrix}SO_3Na.\\SO_3Na.\end{matrix}\right.$$

Mixed with five times its weight of caustic soda, the

* *Wagner's Jahresberichte*, 1874.
† *Belg. Academie*, Aug. 3, 1867.
‡ *Journal für Praktische Chemie*, viii., p. 43.

mass is baked in iron vessels, fitted with an agitator, and heated up by means of an oil-bath. The temperature should not rise above 250° C., and the operation will not last longer than 24 to 36 hours.*

The melt, taken out, is diluted in water, and sulphuric or muriatic acid added in a fine stream. The so-obtained liquid contains the resorcin in a free state, and sulphate of soda or NaCl.

By letting the cold fluid stand quietly a great part of the sulphate of soda is allowed to crystallise out, and can be separated by filtering. Brought into a mixing apparatus and treated with ether, the latter dissolves the resorcin. The ether, swimming on the surface, is drawn off, and the resorcin will be obtained as residue by evaporating the ether in a still. It is a yellow, transparent mass, ready for working up.

It is remarkable that, by re-crystallisation from boiling benzol, the resorcin can be obtained in quite colourless crystals.

The manufacturing of this body is of a very recent date, and many improvements are still to be made. So, *e.g.*, the heating up of the sulphuric acid to 240° C. is as needless as noxious, the destruction of a part of the benzol taking place. The evaporating to dryness of the sulpho-salt is very disagreeable in working on a large scale—wasting time, space, and steam; an evasion of the extraction with ether would at all events be of great influence on the price of the article. Tests of the state of the melt would have to be made upon non-attacked sodium-salt of the disulpho-benzolic acid, and the possible intermediate product of phenol-sulpho-acid,—

$$\left(C_6H_4 \begin{cases} OH \\ SO_3Na \end{cases} \right).$$

The identity in so many points with the manufacture of artificial alizarin at all events realises many experiences made in that older branch.

Properties and Reactions of Resorcin.

It is very soluble in water, alcohol, and ether, crystallising from very concentrated solutions in prisms belonging to the trimetric system. It melts at 104° C. and boils at 201° C., subliming at a lower temperature, and distilling almost without residue. Its aqueous solution is coloured black-violet by ferric chloride, violet by chloride of lime, and reduces silver nitrate to an alkaline cupric solution, throwing down cuprous oxide in the latter case.

(To be continued).

ON THE

PRESENCE OF HYDROGEN PEROXIDE IN THE ATMOSPHERE.

By SERGIUS KERN, M.E., St. Petersburg.

In Moscow, in 1874, Schöne made several experiments on the occurrence of H_2O_2 in rain, snow, dew, and hoar-frost (*Centr. Blatt. für Agrikult. Chemie*, June, 1875). His researches were so interesting that, during the summer time of the last two years, some researches on this question were commenced by the author in St. Petersburg—properly in a village situated about 12 versts higher than the town, on the River Neva.

The present paper refers only to the results obtained in 1877, as the experiments of this year were conducted in a more strict manner.

A. Houzeau is of the opinion that there is a connection between the quantity of H_2O_2 present in the atmosphere and the place where the experiments are executed (*Comptes Rendus*, vol. lxx.). The author, indeed, found a difference between the occurrence of H_2O_2 in rains of St. Petersburg and Moscow. But as the experiments of the author were made in 1877, and Schöne's in 1874, it is rather difficult to give a decided opinion on the remarks of Houzeau. In this case there is a want of further investigations.

The quantity of H_2O_2 in rains was detected by the method proposed by Schöne. A neutral solution of H_2O_2 in water, where the quantity of hydrogen peroxide was examined by titration with mineral chameleon, was used, in order to prepare ten solutions, which contained in 1 litre of water 0·1, 0·2, 0·3, 0·4, 0·5, 0·6, 0·7, 0·8, 0·9, 1·0 m.grms. of hydrogen peroxide. From every such solution 25 c.c. were placed into test-tubes of equal size, and 0·5 c.c. of potassium iodide solution (5 per cent of KI, 95 per cent of H_2O) was next poured into every test-tube, with the addition of 0·5 c.c. of a feeble aqueous solution of starch.

After standing quietly for about ten hours the solutions receive a bluish tint of different colourations.

These ten normal solutions were used in calculating the quantity of H_2O_2 in rain-water, 25 c.c. of which were mixed with the same quantity of potassium iodide and starch solutions as mentioned above. The colouration received was next compared with the normal solutions.

The normal solutions were found to be good for a fortnight.

The following table shows the quantity of hydrogen peroxide found in rains during four months:—

Milligrammes in One Litre of Rain.

	Direction of Wind.							
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
June ..	0·4	0·3	—	0·3	0·8	0·4	0·5	0·1
July ..	0·3	0·1	0·2	0·2	1·4	0·5	0·4	—
August..	0·3	—	0·1	0·1	0·3	0·3	—	0·1
September	0·1	—	—	0·5	0·7	0·2	0·4	—

From this table a graphical disposition of the occurrence of H_2O_2 in rains during the four months may be arranged according to the winds.

The polar winds bring rain poorer in H_2O_2 than the equatorial winds.

Such experiments could be of some use in meteorology if regular observations were commenced in certain points of the earth. Secondly, the occurrence of H_2O_2 in air may be very important for vegetal and animal existence.

TEST FOR ELATERIN.

By DAVID LINDO.

The active principle in elaterium affords a very beautiful reaction with carbolic acid, and concentrated sulphuric acid. The test may be applied as follows:—

Place a few crystals of elaterin in a small porcelain capsule, and add one or two drops of liquefied crystals of carbolic acid (Calvert's No. 1 liquefied by moisture).

The elaterin dissolves in the carbolic without production of colour; but if two or three drops of concentrated sulphuric acid are allowed to flow into the mixture, an intense and beautiful carmine colour is developed, changing at first to orange, and after some time to scarlet. Alkalies discharge the colour. I have not been able to obtain a reaction resembling this with any of the alkaloids and carbolic acid, nor with any other substance tried.*

If liquefied crystals of carbolic acid are not at hand the solid crystals can be used. After adding them to the elaterin, add a drop of chloroform or alcohol before applying the sulphuric acid. The addition of sulphuric acid alone to elaterin gives rise to no characteristic colour.

* If a nitrate in the *dry* state is treated in the same way with carbolic and sulphuric acids, a deep green colour is developed, which changes to red on the addition of a little water.

* M. L. Durand, *Moniteur Scientifique* (3), vi., 696.

The elaterin cakes together, dissolves slowly, and imparts a yellow colour to the acid. If the carbolic is now added the reaction is obtained very imperfectly. The reagents should therefore be added in the order stated above.

The test can be applied direct to some samples of the elaterium of commerce (dried sediment of the juice) if they are reduced to fine powder.

Other samples may require the powder to be agitated with chloroform and the solution filtered. A few drops of the filtrate evaporated to dryness by blowing on the surface will afford a residue for testing.

Falmouth, Jamaica,
December 6, 1877.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, January 17, 1878.

Professor ODLING, Vice-President, in the Chair.

AFTER the confirmation of the minutes of the previous meeting, the reading of presents to the Library, &c., the following certificates were read for the first time:—W. Hudson, G. S. Johnson, T. Lichtenstein, W. B. Lowe, and L. T. Wright.

The CHAIRMAN then announced that a ballot for the election of Fellows would take place at the next meeting of the Society (Feb. 7).

The first paper was entitled "*On the Luminosity of Benzol when Burnt with Non-luminous Combustible Gases*," by E. FRANKLAND and L. T. THORNE. It was pointed out by Dr. Frankland in 1852 (*Memoirs Manchester Lit. and Phil. Soc.*, 2nd Series, x., 71) that hydrogen, carbonic oxide, and marsh gas practically contribute nothing to the luminosity of coal gas, and that the only constituents of value were benzol, ethylene, propylene, butylene, and acetylene. The authors have endeavoured to determine the luminosity of benzol individually, and propose in future papers to make similar experiments on the other illuminating constituents of coal gas. Many attempts were made to burn benzol with a smokeless flame, and several lamps were constructed by Mr. Silber, but all the experiments yielded unsatisfactory results, and the authors had to limit their experiments to the determination of the luminosity of benzol vapour after dilution with hydrogen, carbonic oxide, and marsh gas. These three gases were severally prepared in the usual way, and were passed through a brass cylinder, 6½ inches long, 3 inches internal diameter, packed with sponge saturated with pure benzol, the whole being kept at a constant temperature by immersion in water. The quantity of benzol in the gas was determined by absorption with sulphuric acid. The authors obtained the following numbers:—

1 cub. foot of benzol vapour burnt with hydrogen gave for one hour the light of ..	69·71 candles.
Ditto with carbonic oxide	73·38 ,,
Ditto with marsh gas (1st series)	92·45 ,,
Ditto with marsh gas (2nd series)	93·94 ,,

at the standard temperature and pressure. Hence, 1 lb. avoirdupois of benzol gives, when burnt with hydrogen, the light yielded by 5·793 lbs. of spermaceti; with carbonic oxide, 6·100; with marsh gas (1st series), 7·682; with marsh gas (2nd series), 7·803; or, in other words, a given weight of benzol produces 5·3 per cent more light when it is diluted with carbonic oxide, and between 32·6 and 34·7 per cent more light when diluted with marsh gas than when diffused in hydrogen. The authors point out that this difference is probably due at all events in part to the different pyrometric thermal effects of the gaseous mixtures. A fish-tail burner was used throughout the experiments.

In reply to the CHAIRMAN, Dr. FRANKLAND stated that this increase in the illuminating power of benzol when mixed with marsh gas was not opposed to his former statement, that marsh gas did not contribute materially to the illuminating power of coal gas, because in coal gas the principal hydrocarbons were ethylene and members of that series, which would not raise the temperature to any considerable extent when burnt with marsh gas as compared with the effect produced by benzol vapour and marsh gas.

After the thanks of the Society had been given to the authors, Dr. GILBERT, Vice-President, took the Chair.

The next paper was read by Mr. PERKIN, "*On the Action of Reducing Agents on Potassium Permanganate*," by F. JONES. Hydrogen in neutral solutions decomposes permanganate according to the following equation: $2KMnO_4+8H=Mn_2O_3+2KHO+3H_2O$; the reaction is hastened by raising the temperature. In solutions rendered acid by sulphuric acid hydrogen produces a similar decomposition. In alkaline solutions a similar action takes place, but much more slowly, a manganate being first formed. Ammonia produces the decomposition—

$$8KMnO_4+8NH_3=$$
$$=4Mn_2O_3+KNO_3+KNO_2+6KHO+9H_2O+6N$$

Phosphine when passed through a series of flasks containing solution of potassium permanganate forms sesquioxide of manganese, phosphorous and phosphoric acids, $6KMnO_4+4PH_3=$

$$=3Mn_2O_3+2K_2HPO_3+2KH_2PO_3+3H_2O$$

and $2KMnO_4+PH_3=Mn_2O_3+K_2HPO_4+H_2O$. Arsine produces a similar reaction,—

$$2KMnO_4+AsH_3=Mn_2O_3+K_2HAsO_4+H_2O.$$

The reaction with stibine is—

$$2KMnO_4+SbH_3=Mn_2O_3+K_2HSbO_4+H_2O.$$

The first action of oxalic acid on potassium permanganate results in the formation of manganese and potassium oxalates, water, and carbonic acid. A further addition of permanganate precipitates manganese sesquioxide, carbonic acid and oxygen being evolved, and potassium carbonate formed. In the presence of sulphuric acid oxygen is given off. Oxygen is also evolved with carbonic acid, when sulphuric acid acts on manganese dioxide in presence of an oxalate. When strong solutions of permanganate and manganese chloride are mixed, sesquioxide of manganese separates out, whilst bubbles, consisting of chlorine and oxygen are evolved. By mixing dilute solutions oxygen, but no chlorine, is evolved. Solutions of ferrous and manganese sulphates similarly evolve oxygen when mixed with solutions of potassium permanganate.

Mr. HOWARD remarked that in the Exhibition at Paris, 1867, a compound was exhibited which was said to be permanganate of ammonium; it exploded eventually with some violence. It was curious that such a compound could have been formed and sent to the exhibition when, according to the reaction in the above paper, ammonia decomposes permanganate soon after the substances are mixed.

The next paper was read by Mr. SPENCER PICKERING, "*On the Action of Sulphuric Acid on Copper.*" According to the author there are only two primary reactions. The first is represented by the equation—

$$Cu+2H_2SO_4=CuSO_4+SO_2+2H_2O,$$

the second, $5Cu+4H_2SO_4=Cu_2S+3CuSO_4+4H_2O$. Other products which may be formed are due to the subsequent decomposition of the sub-sulphide by sulphuric acid. Pure electrotype-foil, 0·15 m.m. thick, was used, 0·3 grm. being acted on by 16·3 c.c. strong sulphuric acid (sp. gr. 1·843) for thirty minutes. The action commences at 19°, rapidly increasing as the temperature rises. But little gas is evolved until 130° is reached. No gas, such

as oxygen and hydrogen, insoluble in water, is given off, nor any sulphuretted hydrogen liberated during the reaction. The sub-sulphide formed seems to be deposited on the metal itself in a compact layer: it is not oxidised by exposure to air, or by drying in a steam-bath at 100° C. Care was taken that some copper was always left undissolved at the end of the experiment. The author gives in a table the results of many experiments made at different temperatures. At 19° C. 0·00015 per cent Cu dissolved in thirty seconds; at 100° C., 0·052 per cent; at 150°, 1·15 per cent; at 220°, 70·57 per cent; at 270°, nearly 100 per cent in a few seconds. In two experiments the proportion of copper converted into sulphide to that converted into sulphate was found to be 2 : 2·914 and 2 : 2·964. At high temperatures but little sulphide is formed. The action of sulphuric acid on protosulphide is represented by the equation—

$$2CuS+4H_2SO_4=S_2+2CuSO_4+4H_2O+2SO_2.$$

The decomposition of the subsulphide by the equation—

$$Cu_2S+2H_2SO_4=CuS+CuSO_4+2H_2O+SO_2.$$

The author thinks that the formation of the copper sulphide is due to the direct union of the copper with the sulphur in the acid, which opinion is supported by quantitative experiments and various theoretical considerations. The quantities of sulphuric acid actually used in the experiments, and the amount of the sulphurous acid evolved were determined, and found to agree with those required by the above equations. In some experiments a small sublimate of sulphur was observed round the neck of the flask in which the copper had been dissolved. This is probably due to the tendency of free sulphur to creep up the sides of the containing vessel. The effect of an electric current was tried. When the copper was rendered electro-positive it dissolved more rapidly and more sulphide was formed. When it was electro-negative more sulphate was produced and less sulphide. In some experiments the coating of sulphide protected the copper from the action of the acid to a notable extent. If the copper used be impure it dissolves more rapidly, and two sulphides are formed, owing to the rapid formation of subsulphide and its subsequent decomposition by the acid. The author suggests that the increased action of the acid on impure copper may be due to some sort of catalytic action of the impurities, analogous perhaps to the solution of alloys of platinum and silver in nitric acid. The action of dilute acids was also investigated. In conclusion, the author gives a *resumé* of the explanations which have been offered from time to time of the action of sulphuric acid on copper by previous experimenters, and criticises their results.

The next communication was "*On the Analysis of Sugar*," by G. JONES. The author proposes to estimate sucrose volumetrically by adding a 0·1 per cent solution to a decinormal solution of permanganate acidulated with sulphuric acid until the dirty brown hydrated peroxide of manganese, which is at first formed, is reduced and dissolved. The solution, contained in a porcelain dish, is boiled after each addition of the saccharine liquid. No analyses are given, but the author states that in every case he obtained results which fully justify him in drawing attention to the process. The colouring matters in sugar do not seem to affect the value of the estimations.

Mr. WARINGTON drew attention to the fact that this use of permanganate must be limited to cases in which the sugar was tolerably pure, and that it would be useless for determinations of the sugar present, *e.g.*, in the juice of the beet-root, &c.

The last paper was "*On the Decomposition-Products of Quinine*, by W. RAMSAY and J. DOBBIE. 5 grms. of quinine were gently heated with 50 grms. of permanganate in solution. After complete reduction the alkaline liquid was filtered, neutralised with nitric acid, and precipitated with nitrate of lead. The precipitate was decomposed by sulphuretted hydrogen, the new acid converted into a silver salt, and the latter decomposed by sulphuretted hydrogen. The filtrate, evaporated *in vacuo*, furnished needle-like crystals of a new acid, which proved to be dicarbo-pyridenic acid, identical with that obtained by Dewar from picoline. It gave 9·6 per cent water, 3·16 per cent H, and 44·56 per cent C. Dicarbo-pyridenic acid contains 9·83 per cent water, 3·00 H, and 50·30 per cent C. The new acid contains nitrogen, melts at 251° to 252°, gives a red colour with ferrous sulphate, and a characteristic odour on heating. The silver salt gave 56·21 per cent Ag, and behaves like mercury sulphocyanide. By titration the potassium salt contains 32·5 per cent K, the soda salt 21·76 per cent Na. The salts of dicarbo-pyridenic acid contain respectively 56·69 per cent Ag, 32·15 per cent K, and 21·80 per cent Na. Besides the acid, some quantity of a red deposit was obtained. The yield of this substance was diminished by effecting the reaction at 100°, whilst the yield of acid was increased. By oxidising Marchand's quinetin with permanganate, the authors obtained an acid identical with the one above described.

The Society then adjourned to February 7, when the following papers will be read:—"Notes on the Tannins," by Dr. Paul and Mr. Kingzett; "On a Method for the Determination of Boiling-points," by H. C. Jones; "On the Alkaloids of the Aconite Family (Part II., the Alkaloids of *Aconitum ferox*)," by Dr. Wright and Mr. Luff; "An Enquiry into the Action of the Copper-Zinc Couple on Alkaline Oxy-salts," by Dr. Gladstone and Mr. Tribe; "On the Estimation of Phosphorus in Iron and Steel," by E. Riley.

PHYSICAL SOCIETY.

January 19, 1878.

Professor G. C. FOSTER, F.R.S., President, in the Chair.

THE following candidates were elected members of the Society:—J. Angell, Lieut. G. S. Clark, R.E., T. F. Iselin, M.A., J. W. Russell, M.A.

Mr. W. H. PREECE read a paper "*On Some Physical Points Connected with the Telephone.*" This instrument may be employed both as a source of a new kind of current and as the detector of currents which are incapable of influencing the galvanometer. It shows that the form and duration of Faraday's magneto-electric currents are dependent on the rate and duration of motion of the lines of force producing them, and that the currents produced by the alteration of a magnetic field vary in strength with the rate of alteration of that field; and further, that the infinitely small and possibly only molecular movement of the iron plate is sufficient to occasion the requisite motion of the lines of force. He pointed out that the telephone explodes the notion that iron takes time to be magnetised and de-magnetised. Mr. R. S. Brough has calculated that the strongest current employed in a telephone is $\frac{1}{10000000}$th of the CGS unit. Mr. Preece explained that the dimensions of the coil and plate depend on the strength of the magnet, but the former should always consist of fine wire and be made as flat and thin as possible. The adjustment of the position of the magnet (as near as possible to the plate without touching) is easily effected by sounding a vowel sound *ah* or *o* clearly and loudly; a jar is heard when they are too near together. After briefly enumerating the attempts which have been made to improve the instrument he mentioned the various purposes to which it can be applied. In addition to being useful in the lecture room in conjunction with several well-known forms of apparatus, it forms an excellent detector in a Wheatstone bridge for testing short lengths of wire, and condensers can be adjusted by its means with great accuracy. M. Niaudet has shown, by employing a doubly wound coil, that it can be used to detect currents from doubtful sources of electricity, and it is excellent as

a means of testing leaky insulators. Among the facts already proved by the telephone may be mentioned the existence of currents due to induction in wires contiguous to wires carrying currents, even when these are near each other for only a short distance. Mr. Preece finds that if the telephone wire be enclosed in a conducting sheath which is in connection with the earth all effects of electric induction are avoided; and, further, if the sheath be of iron, magnetic induction also is avoided, and the telephone acts perfectly. A great number of experiments on the use of the instrument on telegraphic lines were then described, from which it appears that conversation can be carried on through 100 miles of submarine cable, or 200 miles of a single wire without difficulty with the instrument as now constructed. The leakage occurring on pole-lines is fatal to its use in wet weather for distances beyond five miles. An interesting series of telephones was exhibited, and by means of one of very large dimensions Mr. Preece showed that the current produced by pressing the centre of the plate sensibly affects a Thomson galvanometer, and that the motion of the needle ceases in a remarkably instantaneous manner, as soon as the pressure is removed, a necessary condition, in order that the receiving-plate should accurately reproduce the motions of the sending-plate.

In the discussion which followed,

Mr. R. Sabine suggested that the failure of all attempts at improving the instrument by increasing its dimensions might be due to the *damping* action of the permanent magnet on the plate, the strain on it being proportional to the size of magnet, and rendering it less sensitive to the sonorous waves.

Mr. Coffin pointed out how interesting it would be if, instead of employing a receiving instrument, the currents could be communicated directly to the auditory nerves.

Prof. Adams explained the relation subsisting between the character of the vibrations of the disk and the character of the electric currents to which they give rise.

Dr. Lodge described a simple form of apparatus for determining the thermal conductivity of rare substances, such as crystals, which cannot be obtained in slabs or rods. It consists of two small tin cans with a copper arm about 8 inches long projecting horizontally from each, the external ends being clean and flat. They are placed in a straight line with the crystal between them, and held together by a slight horizontal pressure. Holes are drilled in the copper rods for thermometers, and the curves of temperature being given by these, that for the intermediate crystal can be at once calculated.

CORRESPONDENCE.

AMMONIA IN FILTERED WATER.

To the Editor of the Chemical News.

Sir,—Mr. Slater's statement that no chemist would condemn a water because of the excessive amount of free ammonia found under certain conditions, emboldens one to ask if unwittingly many chemists do not do so?

One of the most important items to be considered in reporting upon the quality of a water is the geological nature of the strata, and this information is rarely asked for. Spongy iron produces large quantities of ammonia in water passed over it, but it must also be considered that *natural* water from ferruginous strata are under the same influences: the presence of large quantities of ammonia in water from the London Clay and from the Greensands is thus generally occasioned. The "Sixth Report of the Royal Rivers Commission" thoroughly deals with the geological question, and it will be observed that the analyses of water from all strata containing much iron resemble the analyses of water passed over spongy iron, in containing much ammonia and little nitrates.

In November, 1876, I was engaged on the question of a filter, to filter large quantities of water, especially with a view to the removal of nitrates and nitrites. The water was passed, at a rate of 3 litres per hour, over 21 ounces of spongy iron. The experiments were far from complete, and have not since been thoroughly entered upon from want of time. Another well-known filtering medium was absorbed at the same time.

Expressed in parts per 100,000, the results obtained from the Lambeth Company's water and from an exceedingly bad water are—

	Lambeth Company.		Bad Water.	
	Unfiltered.	Filtered.	Unfiltered.	Filtered
Ammonia	0·001	0·075	0·010	1·000
Albumenoid ammonia	0·016	0·003	0·036	0·035
Organic carbon ..	0·289	0·040	0·406	0·200
Organic nitrogen	0·036	0·003	0·228	0·079
Nitrogen as nitrates	—	—	6·540	6·248
Total combined nitrogen	—	—	6·776	7·150

Now it will be observed in this instance, as also in those of waters which have been passed over the spongy iron at a rapid rate, and from which the ferric hydrate has not been removed, that the total combined nitrogen is less before filtration, and consequently again must have taken place during filtration: below I will further allude to this. The comparative experiments with another filtering medium tend to show—That a large elimination of organic nitrogen takes place when water is passed over a spongy iron, while the carbon is not reduced in a corresponding ratio taken on the same water, and I am led to believe that oxidising filters especially remove organic carbon; reducing filters especially remove organic nitrogen; the action of spongy iron does not produce nitrites from nitrates, and their removal, even when the water is passed very slowly, is not more than 0·5 part of nitrogen per 100,000.

It is unfortunate that the "Sixth Report of the Royal Rivers Commission" does not mention the action of spongy iron on waters containing more than 0·25 part per 100,000 of nitrogen or nitrates.

The following experiment, which I have made previous to writing this letter, will suffice to show that the gain of nitrogen is not all due to reduced nitrates. A sample of ordinary recently-distilled water, containing ammonia 0·013 part per 100,000, was passed over the same spongy iron (which had been kept under water): it then contained ammonia 0·095 part per 100,000. The remainder was again passed over spongy iron, but no practical increase was found. Distillation, of course, was employed in the determination, and not more than ten minutes elapsed between the filtrations.

I hope, when I can obtain time, to again work upon the subject. It would be interesting to note if, by re-aëration, a further quantity of ammonia could have been obtained. The results show that an excess of 0·082 part per 100,000 of ammonia, equivalent to 0·067 of nitrogen, has been obtained.

In conclusion, I would add that these experiments were conducted in Messrs. Gillman and Spencer's laboratory.—I am, &c.,

James Death.

Laboratory, St. George's Road, Southwark, S.E.,
January 16, 1878.

THE INSTITUTE OF CHEMISTRY.

To the Editor of the Chemical News.

Sir,—Now that the "Institute of Chemistry" has been the means of drawing prominent attention to the present unsatisfactory state of the chemical profession, and with

especial reference to the pertinent remarks about "the young English chemist" and the "careless place-man" in Mr. Wanklyn's letter in the Chemical News of the 11th inst., I would ask space for a few remarks on the whole subject of Principals and Assistants.

It seems to me that as long as chemical manufacturers and others requiring analyses accept the report of a Ph.D., D.C.L., or F.R.S., in preference to that of less distinguished chemists of presumably far greater experience than the *assistants* of the said Ph.D.'s, &c., so long will the status of analytical chemists be unsatisfactory. It seems perfectly monstrous that the analysis of an experienced man should be set aside by that of a mere boy acting as assistant to one of the leaders of the profession. I know positively that a certain eminent agricultural chemist never touches a beaker from one year's end to another, but merely comes to his laboratory to sign reports as a merchant signs cheques. I do not wish to doubt in the slightest degree the accuracy and conscientiousness of the assistant or assistants, but I am certainly of opinion that the report should be signed by the person who makes the analysis and countersigned by the principal. Indeed, I am astonished that the question has not arisen before, where criminal proceedings are taken, in cases of adulteration for instance. Probably it is because the magistrates have not been aware of the extent to which working by means of assistants is carried on: indeed, if on the bench myself I should be very unwilling to asperse the character of a defendant without asking the analyst if he could swear *personally* to the accuracy of the results. It is quite a different matter in the other professions, for a lawyer or civil engineer can glance over the work of his assistants, and so check it completely. But in chemistry everything depends on individual manipulation, and the principal has absolutely no check on the work, and has to depend entirely on the skill (and honour) of his assistants, who are in many cases boys of seventeen or eighteen, bound to him for three years, and without any remuneration. How can the work be done as accurately by these machines as by the principal?

A radical change is necessary. There are now some few chemists conscientious enough to refuse analyses because they are not practised in the special branch required. It ought not to be expected that one man should be thoroughly well up in the examination of every product. Another objectionable practice is that of reporting percentage to hundredths, or even thousandths in some few cases, whereas everyone knows that the tenths in an ordinary analysis differ (if a duplicate determination be made) as much as 2 or 3 or more. What falsehood there is in this system! He must be indeed a good analyst who can obtain results uniformly reliable to within $\frac{1}{500}$ of the amount of pure substance to be estimated.

To raise analytical chemistry to a dignity on a par with other professions our ranks must be recruited by well educated conscientious men thoroughly in love with their work, and not afraid to own their ignorance of a special branch of the science. We must have more principals and fewer assistants, by which means *machine work* will be abolished, a living interest displayed, and consequently accuracy greatly increased. In short, analytical chemists must act like other professional men, and as a gas engineer would refuse to undertake the setting-out of a water works, and as the legal profession is divided into solicitors, barristers, &c., so we ought to, and no doubt shall have, sections of chemists devoted specially to the examination of potable waters, nitre, phosphates, &c. In analytical chemistry, as in everything else, there is an irresistible tendency towards specialising.

Let us hope that the day is not far distant when those who require analyses and investigations will not be dazed by the "handles" after a name—or at least when they pay ten guineas to a D.C.L. for work which an ordinary analytical chemist would do for five—they will make sure that they really obtain the *services* of the former instead of the work of an assistant. If not, the *signature* of the Professor, &c., &c., seems rather dearly paid for, to my mind at all events.—I am, &c.,

Analytical Chemist.

THE INSTITUTE OF CHEMISTRY.

To the Editor of the Chemical News.

Sir,—The subject of the above Institute seems likely to be tolerably well ventilated in your columns, and I think there can be but one opinion as to the desirability of plentiful discussion. Perhaps you will kindly again allow me space for a few remarks. Mr. Groves's letter in your last issue is satisfactory as far as it goes, but it might have gone just a little further without any fear of becoming too lengthy. We now know the names of all the Officers and Council. It would be of great interest to know also the names of the original "organisation committee" which elected these gentlemen, and I cannot see any reason why these names should not also be published, thus assisting chemists to form a true and just estimate of the whole organisation. I believe the Institute has everything to gain and nothing to lose by giving full information, and taking the profession frankly into confidence. Mr. Groves might, I think, have said rather more as to the course of action which the Institute intends, or hopes, to pursue in furtherance of its objects, and as to how its influence and its funds will probably be brought to bear. But probably much could not be said as yet on this subject, and as Mr. Groves offers every information to everybody who cares to write for it, I think there is no further cause for complaint. As regards the legal liability of Fellows, Mr. Pettengill gives a sufficiently clear explanation in his letter; though what he means when he speaks of "the proved and ever-changing" requirements of chemists is probably known only to himself.

I may again state that my object in writing was sincerely that of a "Well Wisher," and I am very sorry to see the animosity which appears in some of the subsequent letters. But it seemed to me that those in charge of the Institute were committing a very grave mistake in going to work too quietly—indeed with an appearance of almost secrecy—and that thereby they would excite suspicion and ill-feeling, and lay themselves open to many unfavourable criticisms and insinuations.

For my own part I believe (and I trust the opinion may be shared by my fellow chemists generally) that some such organisation is necessary, and that if it were delayed till some scheme could be devised which should please all and offend none, most of us should have done with chemistry and all other earthly business long before anything could be effected. Even as it is we have waited a long time since the organisation was first proposed. Now, at last, something is offered to us, and I for one think that chemists cannot do better than cordially support it and make it a success. What it will eventually become will depend on the body of chemists who incorporate themselves with it; for, as I understand the matter, the present Council will take charge of the affairs of the Institute only for a time, and then an opportunity will be given for a complete re-arrangement and settlement of the whole organisation, guided by the experience gained in the meantime and by the collective wishes of the Fellows. Will it not be best—if we are *ever* to have a society to represent professional chemistry—to come forward and join this Institute, support it and the present governing body for a time, even though perfection may not be reached all at once, and eventually, after due trial and experience, consult and arrange for the future policy and government?

Dr. Muter makes a passionate appeal to us not to "humble ourselves" by submitting to the vote of the Council, or as he prefers to say, "the present directors of this limited company." I think most chemists will see the weakness of the grounds on which he rests this appeal. The difference between this proposed organisa-

tion and that of the medical profession is so great that I wonder Dr. Muter, or anyone else, can compare them. The medical profession is organised by law, and not for the protection of the doctors, but for that of the public. A man without the proper degrees may not practise medicine at all, and can be punished if he does. Of course it was necessary to admit everybody who was in practice when the law was passed, or those excluded may have been ruined. If any similar legal enactment were going to be made for the chemical profession it would then be necessary to admit every chemist who was living by his business at the time. But no such legal enactment is ever likely to take place for us; and how can anybody compare the organisation of a profession which is strictly controlled by law in order to prevent the public being slaughtered by unqualified persons with the organisation of a spontaneous union of chemists to attempt to better themselves and their profession? If every chemist were to be admitted at once, what would be the object of seeking fellowship? Is not one of the chief objects of the Institute to make some distinction between the "sheep and the goats," between those who have had a proper education for, and experience in, their profession and those who have neither the one nor the other? Are those of us who have trained ourselves by years of study, and have invested as much time and money in our profession as doctors, lawyers, &c., do in theirs, to go on for ever tacitly allowing ourselves to stand on a level with the crowd of unqualified humbugs, the "bottle-washers," the druggists who undertake to do analytical work in the intervals of making pills and lotions, and other interlopers too numerous to specify? I think the answer of chemists to these questions cannot be doubtful, and now that an attempt is being made to do something it is to be hoped that the attacks of Messrs. Muter, Wanklyn, and others will not deter chemists from supporting and assisting the movement, especially as these gentlemen do not offer us anything better. If we let them succeed in arresting the progress of this movement we may live many years and never see anything definite again attempted. Dr. Muter speaks of the "vanity" of certain people being "tickled" by the formation of the Institute. Perhaps it is a pity that more attention was not given to the tickling of vanity, as a good deal of opposition might so have been avoided!

Your correspondent, "Nemo me impune lacessit" (bless his long name!) encourages chemists by the assurance that their practice will not be interfered with by the Institute. Perhaps this is correct; but in any case I hope the bulk of our profession is made up of men who can rise a little above such a reflection as that of whether they are going directly and immediately to gain in purse or not by a movement like the present. Any chemist who can see no reason for a movement of organisation, or for giving his support, unless he can think he will at once thereby "put money in his purse" takes indeed a lowly view of things; and a profession made up of such men would deserve to remain in the state in which it now is, and into which it threatens to sink still deeper. I think better of my fellow chemists than this, and believe and hope that they will show that they think somewhat as I do. I believe that mistakes have been made in the starting of this Institute, and it was this that caused me to write first. But I believe that we shall see nothing better offered to us for many a day, and that the Council and Officers of the Institute are much removed above the mean and untrustworthy motives and conduct which have been imputed to them. I do not sign my name. It does not matter who I am, except that I am a trained chemist living by my profession, and that I have had no manner of connection with the organisation of the Institute. I simply appeal to my fellow chemists not to let themselves be led away from the chance we now have of doing something to fight the "bottle-washer" and his clan: and I again point out that when once a strong organisation is formed its policy and government can be altered if desired, and have such form given to them as shall seem best to the majority of the Fellows; so that even if there were for a time causes for dissatisfaction these could in due course be remedied. Surely this is better than standing idly waiting till perfection comes before us all at once!—I am, &c.,

Well Wisher.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Acadmeié des Sciences. No. 26, December 24, 1877.

Rotatory Power of Meta-styrolen.—M. Berthelot.—Styrolen is a carbide of hydrogen, $C_{16}H_8$, a polymer of acetylen, and may be obtained by direct synthesis, either by condensing acetylen by heat, or by combining it directly with benzol, another polymer of acetylen. But the natural carbide is distinguished by the existence of a rotatory power. It turns polarised light to the left—

$$\left(\alpha_D = -3{\cdot}4^\circ\right).$$

The author has also shown that this property belongs to the perfectly pure carbide, free from oxygenated products and from all foreign matter.

Liquefaction of Oxygen.—M. Dumas, before making known to the Academy the important results obtained almost simultaneously by M. L. Cailletet and M. Raoul Pictet, on the liquefaction of oxygen, read the following extract from the works of Lavoisier ("Recueil des Mémoires de Chimie de Lavoisier; Œuvres de Lavoisier publiés par le Ministère de l'Instruction publique," t. ii., p. 804). This passage shows how the immortal creator of modern chemistry foresaw the facts which have been subsequently realised by Faraday and his successors:—"Let us reflect for a moment what would happen to the different substances composing the globe if its temperature were suddenly changed. Suppose, for instance, that the earth were transported at once into a much hotter region of the solar system,—into a region where the average temperature were much higher than that of boiling water,—very soon the water, and all other liquids capable of evaporation at temperatures bordering upon that of boiling water, and even certain metallic substances, would expand, and become transformed into aëriform fluids, which would then become part of the atmosphere. On the contrary, if the earth were suddenly placed in very cold regions,—for, instance, in those of Jupiter or Saturn,—the water which at present forms our rivers and seas, and probably the greater number of the liquids which we know, would be transformed into solid mountains. On this supposition the air, or at least a part of the aëriform substances which compose it, would doubtless cease to exist in the state of an invisible fluid for want of a sufficient degree of heat; it would return to the state of liquidity, and this change would produce new liquids of which we have no idea."

Condensation of Oxygen and of Carbonic Oxide.—L. Cailletet.—If we enclose pure oxygen or carbonic oxide in a tube of the form which I have describe dand placed in the compression apparatus which was set in action before the Academy, and if the gas is reduced to the temperature of −29° by means of sulphurous acid, and exposed to a temperature of about 300 atmospheres, these two gases remain in the gaseous state. But if they are suddenly released—which ought to produce, according to Poisson's formula, a further reduction of temperature of at least 200°—we see immediately a thick mist pro-

duced by the liquefaction, and perhaps by the solidification, of the oxygen or carbonic oxide. A similar phenomenon is observed on the escape of carbonic acid, and of the protoxide and binoxide of nitrogen, after being strongly compressed. This mist is produced in the case of oxygen even when the gas is at its ordinary temperature, provided that time is allowed for it to lose the heat which it has acquired by the mere fact of compression. This was demonstrated on December 16th, in the chemical laboratory of the superior Normal School, before a certain number of *savants* and professors, including some members of the Academy of Sciences. I had hoped to meet at Paris, in addition to the materials necessary for the production of intense cold (liquid protoxide of nitrogen or carbonic acid), a pump capable of being substituted for the compression-apparatus which I fitted up at Chatillon-sur-Seine. Unfortunately a pump well-arranged and suitable for such experiments was wanting in Paris, and I was obliged to bring from Chatillon-sur-Seine the refrigerants necessary for collecting the condensed matter on the walls of the tube. To decide if the oxygen and the carbonic oxide are in a liquid or in a solid state, there is merely required an optical experiment, more easy to imagine than to realise, on account of the form and the thickness of the tubes in which they are contained. Certain chemical experiments will also permit us to decide that the oxygen is not transformed into ozone in the act of compression. I reserve to myself the study of all these questions by means of apparatus which is being specially constructed. Under the same conditions of temperature and pressure pure hydrogen, released with the greatest rapidity, gives no trace of nebulous matter. Nitrogen only remains to be studied from this point of view, and its sparing solubility in water permits me to consider that it will prove very refractory.

Experiments of M. Raoul Pictet on the Liquefaction of Oxygen.—M. de Loynes.—The substance of this paper and of a communication from M. Pictet to M. Dumas, read at the Session of the Academy, December 24th, appeared in the CHEM. NEWS (vol. xxxvii., p. 1). M. Dumas also read the following letter, which had been addressed by M. Cailletet to M. H. Sainte-Claire Deville, on December 2nd, and which the latter had felt it his duty to deposit the next day, as a sealed paper, in the hands of the Perpetual Secretary :—

"I have to tell you first, and without losing a moment, that I have just this day liquefied oxygen and carbonic oxide. I am perhaps doing wrong to say liquefied, because at the temperature obtained by the evaporation of sulphurous acid, say $-29°$, and at a pressure of 300 atmospheres, I see no liquid, but a mist so dense that I infer the presence of a vapour very near its point of liquefaction. I write to-day to M. Deleuil to ask him for some protoxide of nitrogen, by means of which I shall be able, without doubt, to see oxygen and carbonic oxide flow.

"PS. I have just made an experiment which sets my mind greatly at ease. I subjected hydrogen to a pressure of 300 atmospheres, and after cooling down to $-28°$ I released it suddenly. There was not a trace of mist in the tube. My gases (CO and O) are therefore on the verge of liquefaction, as this mist is only produced when vapours are about to liquefy.

"L. CAILLETET.

"December, 2, 1877."

M. H. Sainte-Claire Deville added the following explanations :—M. Cailletet has repeated his experiments on the condensation of oxygen, on Sunday, December 16th, in the laboratory of the Normal School : they have succeeded perfectly, as has been stated in the foregoing note. If this note has not been made public earlier it is because M. Cailletet was a candidate for the position of Correspondent, which the Academy awarded to him in the Session of December 17, and he did not wish to introduce into the discussion of his claims, on December 10th, researches whose results have not been confirmed by an experiment made before competent judges. On the 17th of December, the day of his election, he did not think it becoming to publish a fact of great importance, indeed, but the discussion of which could not take place in the secret committee of December 10th; fortunately I had taken the precaution, on December 3rd, to have the letter containing the announcement of his discovery sealed up and signed by the Perpetual Secretary. The priority belongs to him, therefore, in an incontestable manner. Still the remarkable investigation of M. Raoul Pictet must not be considered as having received any injury, his method of procedure being absolutely different from that employed by M. Cailletet. The process of refrigeration founded upon the escape of a gas or of a vapour, a principle not yet applied, and the simplicity of M. Cailletet's apparatus, will enable the condensation of gases to be shown as an instructive lecture experiment. M. Jamin admitted that the possibility of liquefying or solidifying oxygen was now demonstrated; the two experiments were of equal value; that of M. Pictet added little to that of M. Cailletet, for if the former announces that he has seen the oxygen precipitated in the liquid state everything indicates that it was but a fugitive glimpse, and, on the other hand, the mist observed by M. Cailletet at the instant of escape shows that the oxygen had ceased to be transparent,—that is to say, gaseous,—and had become solid or liquid. To have seen the liquid or the mist, without collecting either, is all one. The final experiment is still to be made: it will consist in maintaining the oxygen liquid at its boiling-point, as has been done with nitrous oxide, or in a solid state like carbonic acid, which is preserved in that condition on account of the enormous latent heat which its gaseifaction would require. There is every reason to hope that the two skilful experimentalists may ultimately meet in this ultimate result. M. Dumas, after what had been said, regarded the mutual independence of the researches of MM. Cailletet and Pictet as absolutely certain. Each one, pursuing the same object, and creating methods and apparatus, has arrived at the same result without any knowledge of the work of his rival. M. Regnault informed the Academy that he had assisted, five years ago, at the first attempts made at Geneva, by M. R. Pictet and M. de la Rive, to obtain the liquefaction of gases. He had been struck with the remarkable arrangement of the apparatus. M. Berthelot, without denying the originality of M. Pictet's experiment, showed that M. Cailletet's researches on the liquefaction of oxygen are the necessary continuation of his researches on the liquefaction of binoxide of nitrogen, published in the *Comptes Rendus* (Nov. 26, p. 1016), and on the liquefaction of ethylen (Nov. 5, p. 851).

New Observations on the Part played by Pressure in Chemical Phenomena.—M. Berthelot.—The author called the attention of the Academy to one of the circumstances of M. Pictet's remarkable experiment. The decomposition of chlorate of potassa into oxygen and chloride of potassium—an exothermic reaction, and not limited by its inverse—is not arrested by a pressure of 320 atmospheres. It is probable that the speed of the reaction is changed, and perhaps also the temperature at which it is effected, but the reaction itself does not cease to take place. This is a further confirmation of the opinions enounced by the author of the present note on a question of such importance for chemical mechanics—opinions contested at first, but which new observations support more and more.

Experimental Researches on Rotatory Magnetic Purification; Magnetic Rotations of Luminous Rays of different Wave-lengths.—H. Becquerel.—The author's experiments show what differences exist between positive and negative magnetic rotations. The ratios of the positive rotations of the various luminous rays are approximately represented by the expression—

$$\frac{n^2(n^2-1)}{\lambda^2},$$

where n represents the index of refraction and λ the wave-length, whilst those of the negative rotations differ little from those deduced from the formula—

$$\frac{n^2(n^2-1)}{\lambda^4}.$$

The positive magnetic rotations of different bodies seem to tend towards a limit depending solely on the index of refraction and on the wave-length, whilst the negative rotations show a much better-marked action of the magnetism developed in the molecules of the substances.

On the Acid Acetates (continued).—A. Villiers.—The author, in this paper, describes certain acetates of strontia, baryta, copper, and manganese.

MEETINGS FOR THE WEEK.

MONDAY, 28th.—Medical, 8.
—— London Institution, 5.
—— Royal Geographical, 8.30.
—— Society of Arts, 8. "Explosions in Coal Mines," by Thomas Wills, F.C.S.
TUESDAY 29th.—Civil Engineers, 8.
—— Anthropological, 8. (Anniversary).
—— Royal Institution, 3. "Protoplasmic Theory of Life, and its Bearing on Physiology," Professor Garrod.
WEDNESDAY, 30th.—Society of Arts, 8. "The Art Manufactures of Japan," Christopher Dresser. Ph.D.
THURSDAY, 31st.—London Institution, 7.
—— Royal, 8.30.
—— Royal Institution, 3. "Chemistry of the Organic World," Prof. Dewar.
FRIDAY, Feb. 1st.—Royal Institution, 8. Weekly Meeting. "The Telephone," Mr. W. H. Preece, 9.
—— Geologists' Association, 8. (Anniversary).
—— Society of Arts, 8. (Indian Section). "The Destruction of Life in India by Wild Animals," oy Sir Joseph Fayrer, M.D., K.C.S.I.
SATURDAY, 2nd.—Royal Institution, 3. "Carthage and the Carthaginians," R. Bosworth Smith, M.A.
—— Physical, 3. (Anniversary).

TO CORRESPONDENTS.

T. E. S.—Your questions are unsuitable to our columns.

Now ready, 8vo., cloth, 30s.

PHOTOGRAPHED SPECTRA. One Hundred and Thirty-six Photographs of Metallic, Gaseous, and other Spectra, printed by the permanent autotype process, with Introduction, Description of Plates, and Index; and with an extra plate of the Solar Spectrum (showing bright lines), compared with the Air Spectrum, by J. RAND CAPRON, F.R.A.S.

London: E. and F. N. SPON, 46, Charing Cross.
New York: 446, Broome Street.

Chemical Technology, or Chemistry in its Applications to the Arts and Manufactures. By THOMAS RICHARDSON and HENRY WATTS. Second Edition, illustrated ith numerous Wood Engravings.

Vol. I., Parts 1 and 2, price 36s., with more than 400 Illustrations.

Nature and Properties of Fuel: Secondary Products obtained from Fuel: Production of Light: Secondary Products of the Gas Manufacture.

Vol. I., Part 3, price 33s., with more than 300 Illustrations.

Sulphur and its Compounds: Acidimetry: Chlorine and its Bleaching Compounds: Soda, Potash: Alkalimetry: Grease.

Vol. I., Part 4, price 21s., 300 Illustrations.

Aluminium and Sodium: Stannates, Tungstates, Chromates, and Silicates of Potash and Soda: Phosphorus, Borax: Nitre: Gun-Powder: Gun Cotton.

Vol. I., Part 5, price 36s.

Prussiate of Potash: Oxalic, Tartaric, and Citric Acids, and Appendices containing the latest information, and pecifications relating to the materials described in Parts 3 and 4.

BAILLIERE AND CO., 20, King William Street, Strand.

J. I. HEADLY, ENGINEER, Cambridge, Maker of Steam Engines, Bone Mills, and other Machiner for Chemical Works; also Whole and Ground Coprolite.

OWENS COLLEGE, MANCHESTER.

The Council is prepared to appoint a DEMONSTRATOR and ASSISTANT LECTURER IN CHEMISTRY, whose time would be required to be devoted entirely to the duties of the office. The fixed stipend will be £100 per annum, Applications, accompanied by testimonials, and addressed to the Council under cover to the Registrar, will be received up to the 26th. inst. The Principal of the College will be glad to give further information respecting the duties and emoluments attached to the Office.

J. HOLME NICHOLSON, Registrar.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

MINERALS, FOSSILS, AND ROCKS.

JAMES R. GREGORY'S
NEW AND EXTENSIVE SHOW-ROOMS,
88, Charlotte Street, Fitzroy Square, London, W.

COLLECTIONS especially prepared for teaching purposes, at all prices from half-a-guinea upwards. Also single specimens, Geological Hammers, Cabinets, Books, Glass-topped Boxes, &c.

Detailed Catalogues (74 pages) free for six stamps.

H. M. CAPNER,

Electrical and Philosophical Instrument Maker to the Trade only.

20, NORTHAMPTON SQUARE, LONDON E.C

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mincralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays.. ..	£2	2 0
200 Specimens, in Cabinet, with 5 Trays.. ..	5	5 0
300 Specimens, in Cabinet, with 9 Drawers ..	10	10 0
400 Specimens, in Cabinet, with 13 Drawers ..	21	0 0

More extensive Collections at 50 to 5000 Guineas each.

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, Londo

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy 'Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

DO YOUR OWN PRINTING.

The "Optimus" Printing-Press for Amateurs. Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A. HERBERT, Printing Warehouse, 50, Finsbury Square. London, E.C.

WATER ANALYSIS.—Prof. WANKLYN, Lecturer on Chemistry and Physics at St. George's Hospital, Public Analyst for Buckinghamshire, Buckingham, High Wycombe, Peterborough, and Shrewsbury, has REMOVED to 7 Westminster Chambers, Victoria Street, S.W.

THE CHEMICAL NEWS.

Vol. XXXVII. No. 949.

ON DYER'S CHEMICALS.

By J. MARZELL.

(Continued from p. 35.)

Methyl-Aniline.*

The methods for methylating aniline being so very various, we shall discuss only those having the most interest for industry.

1. A mixture of 100 parts hydrochlorate of aniline and 50 to 80 parts methyl-alcohol is heated up in an autoclave for several hours. The temperature is carried to 175° to 210° C., and maintained for three or four hours, or even may be raised to 250° to 300° C., in which case the change takes place in two or three hours, or thereabouts. In the latter case great care has to be taken at the beginning of the reaction. At about 280° C. the temperature and the pressure rise suddenly, and therefore, immediately when it occurs, the fire has to be removed till the pressure abates; then it is put on again.

After the reaction the hydrochlorate of the new body remains, and is decomposed by means of soda, potash, or ammonia, and the mixture of mono-, di-, and even tri-methyl-aniline separated by fractional distillation.

The different points of the reaction may be represented in the following figures:—

I. $C_6H_5NH_2.HCl = C_6H_5NH_2 + HCl.$
Decomposed by heat.

II. $CH_3OH + HCl = CH_3Cl + H_2O.$

III. $\left.\begin{matrix}C_6H_5\\H\\H\end{matrix}\right\}N + CH_3Cl = \left\{\left[\begin{matrix}C_6H_5\\CH_3\\H\end{matrix}\right\}N + HCl\right].$

IV. $\left.\begin{matrix}C_6H_5\\CH_3\\H\end{matrix}\right\}N + CH_3Cl = \left\{\left[\begin{matrix}C_6H_5\\(CH_3)_2\end{matrix}\right\}N + HCl\right].$

V. $\left[\begin{matrix}C_6H_5\\CH_3\\H\end{matrix}\right\}N,HCl\right] + KOH = \left\{\begin{matrix}C_6H_5\\CH_3\\H\end{matrix}\right\}N + KCl + H_2O.$
Hydrochlorate. Free base.

2. By mixing aniline with an alcohol and a salt, by preference the chlorides, bromides, or iodides of aluminium, calcium, magnesium, zinc, iron, or other metal. By preference 100 parts aniline, 100 to 150 parts methyl-alcohol, and 80 to 100 parts sal-ammoniac are mixed and heated under pressure to 275° to 300° C., which heat is maintained for two to four hours.

When the reaction is complete the liquid separates into two parts, one of which is oily and contains the new alkaloids. It is digested and purified by washing and distilling.

The reaction takes place in the way above mentioned; the sal-ammoniac is split up into ammonia and hydrochloric acid,—

$$NH_3.HCl = NH_3 + HCl.$$

In consequence of the free NH_3, which forms NH_3HCl again at the end of the reaction, the methyl-anilines are obtained as free bases at once.

3. By action of alkaline haloids (chlorides, bromide iodides) upon aniline, the resulting products will be

a. Methyl-anilines.
b. Hydrate of the used halogen.

I. $\left.\begin{matrix}C_6H_5\\H\\H\end{matrix}\right\}N + CH_3I = \left\{\begin{matrix}C_6H_5\\CH_3\\H\end{matrix}\right\}N + HI.$

II. $\left.\begin{matrix}C_6H_5\\CH_3\\H\end{matrix}\right\}N + CH_3I = \left\{\begin{matrix}C_6H_5\\CH_3\\CH_3\end{matrix}\right\}N + HI.$

III. $HI + KOH = H_2O + IK.$

In taking methyl-iodide great attention is necessary, as the reaction is very violent.

To isolate the methyl-anilines (for there will always be a mixture of mono- and di-derivatives) the melt is decomposed by a concentrated solution of caustic soda or potash. The methyl-anilines are obtained as oil swimming on the surface, are drawn off, washed, and re-distilled.

The autoclave used for this process has to be provided with an arrangement allowing to supply the reagents whilst the operation is going on. This machinery consists of a tube of about 4 inches diameter and 8 inches high, diminished at both ends, and closed by means of cocks. On the top of the upper cock a funnel-shaped head-piece is fixed. The bottom part is screwed into the cover of the vessel.

The operation is effected in the following way:—The bottom cock is shut, the upper one opened, and a part of the respective alkaline haloid put into the tube. Now, by closing the upper cock and opening the bottom one, the communication between the inner part of the autoclave and the tube being affected, without losing any pressure, &c., the stuff is allowed to run in.

The reaction is very violent, and therefore the calculated quantity of alkaline haloid to be added in small portions. As soon as the addition takes place temperature and pressure rise suddenly, and therefore the refrigerator has to be in work. As soon as the falling of temperature and pressure shows the end of the reaction a fresh lot is put in, by manipulating with the cocks in the manner mentioned above, and so on, till all is mixed. Then, after stopping the refrigerator, it is advisable to keep the temperature up at 100° C. for one or two hours. For this purpose the autoclave is set in brickwork, with a fireplace beneath, in such a manner that the flame from the fire may not play directly on the vessel, but the heated air and products of combustion from the fire circulate in flues surrounding the bottom and sides of the vessel.

The apparatus is allowed to cool down, then opened, the necessary quantity of caustic soda supplied, the methyl-anilines digested, washed, and re-distilled, either out of the autoclave itself or from a still especially kept for this purpose.

In reference to the recovery of the used halogen (which is as alkali compound in the residues) Mr. Wanklyn's* process is of great interest. He treats iodide of potassium (KI) or sodium (NaI) with its weight of hydrochloric acid, diluted in methylated spirit (CH_3OH), and distils the mixture. By adding water to the resulting distillate the methyl-iodide is precipitated in a pretty pure state.

4. By mixing together under pressure an alcoholic salt (nitrate or chloride by preference) and aniline, either in equivalent portions or 2 parts of alcoholic salt to 1 part of aniline.

The heat depends on the salt which is used. Taking the nitrate, only 100° C. are to be supplied for three or four hours; but if the alcoholic chloride is employed the heat should be raised to 220° C., or thereabout.

In operating with nitrate the process may be conducted in an earthenware or iron vessel without heat, at the common temperature, but then it will require several days.

* Poirrier and Chappat, *Bull. de la Soc. Chimie*, 1866, vi., p. 502. Patent No. 1912. Ch. Girard and De Laire, "Derivés de la houille" Paris, 1872). A. Würtz, "Matières Colorantes Artificielle" (Paris, 876).

* *Bull. de la Soc. Chimie*, 1867, vii., p. 92. Brevet No. 73,160.

The resulting salts of the alkaloid are then decomposed by alkalies.

5. Equal parts of aniline, hydrochloric acid, and methylated spirit are brought together, and treated with elevated heat at a certain pressure.

The autoclave used is enamelled inside, provided with a safety-valve, a pressure-gauge, and a cock of about ¾ inch, and plunged into an oil-bath. Charged with the materials, a heat of 200° to 220° C. is supplied, the pressure raising up to 25 atmospheres.

The reaction takes place in two parts:—

A. The hydrochloric acid acts upon the methylated spirit, forming chlor-methyl,—

$$CH_3OH + HCl = CH_3Cl + H_2O.$$

B. The chlor-methyl converts the aniline into methyl-aniline,—

$$\text{I.}\quad \left.\begin{matrix}C_6H_5\\H\\H\end{matrix}\right\} + CH_3Cl = \left\{\begin{matrix}C_6H_5\\CH_3\\H\end{matrix}\right\} N + HCl.$$

$$\text{II.}\quad \left.\begin{matrix}C_6H_5\\CH_3\\H\end{matrix}\right\} N + CH_3Cl = \left\{\begin{matrix}C_6H_5\\(CH_3)_2\end{matrix}\right\} N + HCl.$$

In mixing the bodies hydrochlorate of aniline—

$$(C_6H_5NH_2.HCl)$$

will necessarily be formed, but as it is decomposed at 240° C. (according to M. Würtz), with that pressure and heat it will certainly be set free for action.

It is to be observed that the HCl decomposed in A is recovered in B, ready to operate upon another part of alcohol.

Working in this manner, especially dimethyl-aniline—up to 80 to 95 per cent of the aniline started with (Würtz)—is formed.

According to Kern* in this way dimethyl-aniline only will be obtained; and even by interrupting the operation purposely, besides non-attacked aniline no mono-methyl-aniline is to be found. The methyl groups are substituted for the two amido hydrogens.

Ch. Girard† states that, in heating up to 190° to 200° C. a mixture of 100 parts aniline, 120 parts HCl (sp. gr. 1·17), and 38 parts methyl-alcohol, only mono-methyl-aniline, and no di-derivative, is formed.

Whichever way may be followed, after cooling, the autoclave is unscrewed and milk of lime added in a small excess. The free base, swimming on the surface, is digested and re-distilled by steam.

The mass so obtained consists of free aniline, mono- and di-methyl aniline.

By adding hydrochloric acid the aniline is converted into hydrochlorate of aniline ($C_6H_5NH_2HCl$), which precipitates, whilst the HCl salts of the methyl-anilines remain in solution, and can be separated by filtering and pressing.

The separation of the mono- and di-methyl aniline is more difficult to carry out. Commonly fractional distillation is taken as expedient; but in this case it is not of much use, as the boiling-points of the two substances are so very close together.

To isolate mono-methyl aniline from the mixture, A. W. Hofmann takes advantage of the fact that only the mono-methyl aniline is able to form an acetyl compound which can be separated from the dimethyl-aniline according to its properties both of crystallisation or distilling.

The formula shows the reaction as follows:—

$$\left.\begin{matrix}C_6H_5\\CH_3\\H\end{matrix}\right\} N + \left\{\begin{matrix}C_6H_5\\CH_3\\CH_3\end{matrix}\right\} N + C_2H_3OCl =$$

$$= \left\{\begin{matrix}C_6H_5\\CH_3\\C_2H_3O\end{matrix}\right\} N + \left\{\begin{matrix}C_6H_5\\(CH_3)_2\end{matrix}\right\} N, HCl.$$

* *Berichte der Deutsche Chem. Gesell.*, 1875, p. 771.
† *Bull. de la Soc. Chem.*, xxiv., 121.

The conversion into acetyl-derivative can be effected either by acetic acid anhydride, or, better, by acetyl-chloride. The stuff to be treated is brought into a balloon provided with a refluxing condenser and an arrangement like a separating-funnel, allowing to supply the acetyl-chloride gradually. As soon as acetyl chloride is added heating arises, and the end of the reaction can be seen on cooling. If on the addition of a fresh quantity no more reaction can be observed, it shows that all mono-methyl-aniline is converted into its acetyl-derivative. The whole product is then put into hot water, from which the methyl-acetanilide crystallises out on cooling.

The dimethyl-aniline is digested and re-distilled. As the acetanilide only distils at 240° to 250° C., there is no fear that it would spoil the distillate of dimethyl-aniline. By decomposing the acetyl compound mono-methyl-aniline is obtained in a state of great purity.

The reaction by which the methyl-anilines are formed also produces a quaternary base, the chloride of the trimethyl-phenyl-ammonium—

$$\left.\begin{matrix}C_6H_5\\CH_3\\CH_3\end{matrix}\right\} N + CH_3Cl = \left\{\begin{matrix}C_6H_5\\CH_3\\CH_3\end{matrix}\right\} N\!<\!\begin{matrix}CH_3\\Cl\end{matrix}$$

That chloride remains in the aqueous solution, from which the methyl-anilines were digested as oils. By evaporating this solution (containing lime in suspension) to dryness, and distilling the residue by heat.

A. The lime acts upon the chloride, recovering the free base—

$$Ca\left\{\begin{matrix}OH\\OH\end{matrix}\right. + 2\begin{matrix}C_6H_5\\(CH_3)_2\end{matrix}\left\{N\begin{matrix}CH_3\\Cl\end{matrix}\right\} =$$

$$= CaCl_2 + 2\begin{matrix}C_6H_5\\(CH_3)_2\end{matrix}\Big\} N\!<\!\begin{matrix}CH_3\\OH\end{matrix}.$$

B. By dry distillation this base is decomposed into methyl-alcohol and dimethyl-aniline.

$$\underbrace{\begin{matrix}C_6H_5\\(CH_3)_2\end{matrix}\Big\} N\!<\!\begin{matrix}CH_3\\OH\end{matrix}}_{\text{Base.}} = \underbrace{\begin{matrix}C_6H_5\\(CH_3)_2\end{matrix}\Big\} N}_{\text{Dimethyl-aniline.}} + \underbrace{CH_3OH.}_{\text{Methyl-alcohol.}}$$

As a test for aniline, the violet reaction by treating an aqueous solution with chloride of lime may be considered quite sufficient (Kern).

The contradictory results of Kern* and Hepp† against the observations of Hofmann‡, Girard and de Laire,‖ and others, about the formation of mono-methyl-aniline, besides the dimethyl product, induced E. Nölting and I. Boas-Boasson§ to take up again the respective researches. To separate the secondary amine from the products of reaction, containing besides aniline and dimethyl-aniline¶ they follow E. Fischer's method.

The acid solution—not too concentrated, and well cooled down—is treated with nitrite of soda ($NaNO_2$). Aniline will thereby be converted into diazo-benzol-chloride, dimethyl-aniline into hydrochlorate of nitroso-dimethyl-aniline, both remaining in solution, whilst the formed methyl-phenyl-nitrosamine gathers as a yellow oil, which can be taken out by ether. For reducing that nitrosamine (with $Sn + HCl$ or $Fe + C_2O_2H_4$), methyl-aniline is got quantitatively, and showing all the characteristic reactions.

To examine a solution for methyl-aniline, about 1 grm. of the mixture is diluted in slightly weakened hydrochloric acid, a few drops of a solution of the nitrite are added, and the whole shaken with ether. The ethereal extract is dried with chloride of calcium, and evaporated down in a watch-glass on the water-bath. The methyl-phenyl-nitrosamine remains in yellow drops, and can be

* *Berichte der Deutsch. Chem. Gesell.*, 1875, 771.
† *Ibid.*, x., 327.
‡ *Ibid.*, v., 720, and viii., 523.
‖ Matieres colorantes.
§ *Berichte der Deutsch. Chem. Gesell.*, x., 795.
¶ *Ibid.*, viii., 1641.

recognised by its characteristic smell and by Liebermann's reaction.

E. Nölting and I. Boas-Boasson found the yield of mono-methyl-aniline pretty considerable.

(1.) 50 grms. of a mixture of bases, got by the action of 1 mol. iod-methyl upon 1 mol. of aniline, yielded 21 grms. of dry nitrosamine, equal to 16·5 grms. of methyl-aniline.

(2.) 50 grms. of a mixture of bases got by action of 1 mol. of iod-methyl upon 2 mols. of aniline, and separated from iod-hydrate of aniline by ether, yielded 23·5 grms. nitrosamine, equal to 18·5 methyl-aniline.

(3.) The product of reaction of 25 grms. (CH_3OH) methyl-alcohol upon 100 grms. of hydrochlorate of aniline at 235 to 240° C., resulted in 23 grms. of methyl-aniline.

The possibility of forming the methyl-aniline in the technical process is therefore not to be doubted, and the authors really had the opportunity to prove the presence of small quantities of mono-methyl-aniline in two samples of commercial dimethyl-aniline; also a diathyl-aniline yielded small quantities of athyl-phenyl-nitrosamine.

The reaction is a very sharp one, and allows even 1 per cent of methyl-aniline to be detected with certainty.

(To be continued).

ON THE

ESTIMATION OF THE NITROGEN COMPOUNDS IN THE OIL OF VITRIOL OF COMMERCE.*

By GEORGE E. DAVIS.

In December, 1871, Mr. W. Crowder published a paper upon this subject, which was followed by one written by myself, and published in the Chemical News in December, 1871, and January, 1872, and in answer to a query in March, 1872, I gave a *resumé* of the oxidation processes mentioned in the former papers, and so far the subject has remained at rest until September, 1877, when Prof. Lunge communicated some interesting experiments, which appeared in the Chemical News.

It is a curious fact, that although the numbers obtained by the various oxidation processes correspond to the real amounts of nitrogen compounds present, yet this is only the case with certain varieties of vitriols, and the action of the arsenious acid which most vitriols contain has never been commented upon, though it is certain that this compound must have a deoxidising tendency towards the standard oxidising solutions used. In fact, in the three papers alluded to the mention of arsenious compound only occurs in the first portions of my paper (Chem. News, xxiv., p. 258).

It must be evident to every chemist that if arsenious acid existed in the vitriol, the process of examination by either the chloride of lime, or the permanganate method, or the bichromate method, one of which is at present employed in most works, would be incorrect, seeing that arsenic acid would be produced from the arsenious compound, and the amount of the deoxidation would be reckoned as nitrous acid.

The methods of oxidation alluded to can only be exact, or approximately so, when the arsenic compounds are in a state of peroxidation, and the vitriol is free from organic matter and proto-salts of iron, and also when the oxides of nitrogen are all in the same degree of oxidation, and that degree positively known.

It is therefore certain that none of the oxidation methods can be used for estimating with certainty the amount of nitrogen compounds in ordinary pyrites vitriol, and further on I shall proceed to show that only under certain conditions is it permissible to use an oxidation process for the estimation of the nitrogen compounds in brimstone vitriol.

* A Paper read before the Faraday Club.

Oil of vitriol is not such a simple substance as some may imagine. I have found it to contain—

Nitric oxide	Ferrous sulphate
Nitrogen trioxide	Organic matters
,, tetroxide	Sulphurous acid
Nitric acid	Hydrochloric acid
Arsenious acid	Sulphuric acid
Arsenic acid	

I do not mean to infer that all these substances have been found in the same sample of vitriol, but *nearly* all of them have been found in the same sample, and it may be seen that any method of analysis must be one which does not depend upon the deoxidation of standard solutions.

The conversion of the nitro-compounds into ammonia is tedious and difficult in the presence of so much free sulphuric acid. Nitrate of urea is much too expensive to be used in a technical laboratory even if the process was satisfactory, which it is not; and as it is a rapid, easy, and accurate process, under all conditions, which is required, I have great pleasure in laying such a process before you this evening.

In January, 1872, soon after the publication of my paper, I carried on a little correspondence with Dr. John Watts, who advised me to try a modification of Walter Crum's method for the estimation of nitrates in potable waters, basing his advice upon some experiments of his own, saying also that "no nitrogen compound could escape being reckoned."

I have carried on these experiments since that date, not daring to publish anything upon the subject until I had operated upon every variety of vitriol capable of being obtained, and working under every condition which might be required in practice. And, again, I had considered the process exclusively Dr. Watts's, and hoped that he would have brought his process before the notice of technical chemists long since. The method is very simple, and may be briefly described as follows:—

1 c.c. of the vitriol is measured very accurately by means of a fine pipette, and introduced into Frankland's stopcock-tube, standing over mercury. By opening the stopcock the vitriol is allowed to run in, and the cup is washed out with pure strong vitriol, which is also run into the tube. The bottom is now closed with the thumb, and the vitriol agitated with the mercury in such a manner that an unbroken column of mercury always remains between the vitriol and the thumb. The reaction is complete in less than five minutes, and the tube being graduated, the mercury is levelled, and the volume of gas read off. For technical purposes this volume will be found accurate enough, but in cases where extreme accuracy is required the tube must be left to itself for several hours, the temperature and pressure noted, and the necessary corrections made.

The mercury reduces the whole of the nitrogen oxides to nitric oxide (N_2O_2), and the presence of any other compound found in vitriol has no influence on this test. The only precaution to be taken is to have the vitriol in the tube strong enough.

In order to avoid the expense of a deep and well-filled mercury-trough I have designed the one you now see upon the table. There is a well at one end of the trough in which to depress the tube for reading off, and the amount of mercury required to fill the trough is scarcely ten pounds. Messrs. Mottershead, of Manchester, are the makers of these troughs.

It is rather a curious coincidence that when 1 c.c. of vitriol is taken the number of c.c. of N_2O_2 obtained divided by ten gives nearly enough the percentage of N_2O_3. This happens when the vitriol has a density of about 143° T.

This process has been in use with me since 1872, and by its means I have been able to follow well and truly

many interesting reactions connected with the oil of vitriol manufacture.

Processes like the permanganate or bichromate, which depend upon the use of oxidising agents, are of no value at all, and though they sometimes give numbers closely approximating to the real quantities of nitrous acid present, yet those numbers are only obtained by a happy combination of errors, which any slight alteration in the mode of manufacture might soon overturn.

I have been experimenting upon the vitriol of a works all made from the sulphur contained in the spent oxide of iron from gas-works. This vitriol contains no arsenic. There are six chambers working: the mixed gases pass into No. 1 chamber, and exeunt from No. 6. The following results were obtained by the two methods, permanganate and mercury:—

Description.	Sp. Gr.	P. c. N_2O_3 by Permanganate.	P. c. N_2O_3 by Mercury.
Strong acid	1·78	0·008	—
No. 1 chamber ..	1·56	0·024	—
No. 2 ,, ..	1·55	0·017	—
No. 3 ,, ..	1·53	0·172	0·144
No. 4 ,, ..	1·57	0·218	0·228
No. 5 ,, ..	1·47	0·038	0·039
No. 6 ,, ..	1·43	0·024	0·071

The above calculations were made upon the basis that 1 litre of nitric oxide at 0° and 760 m.m. weighs 1·343 grms.

It will be seen from the above table that in the concentrated acid, and in the chambers 1, 2, and 3, the permanganate process has given results in excess of the truth; in fact the permanganate has estimated the proto-salt of iron in No. 1, the organic matters in Nos. 2 and 3, and in Nos. 4 and 5 only do we get the exact measure of the nitrous acid present. In No. 6 the mercury process gives results much in excess of the permanganate, therefore it is evident that of the total nitrogen compounds present in the vitriol some of them must be fully oxidised. This means that there exists in the vitriol from this chamber 0·024 per cent of nitrogen trioxide, the remainder as nitric acid.

Direct evidence of the presence of nitric acid in the vitriol from the last chamber is often obtained in vitriol works. It has often been noticed that when the last chamber of the series has been worked very weak the lead has been rapidly worn away—in fact, worn completely in holes—more especially upon the top liquor-line; this is due to the formation of nitric acid. But as this is not immediately connected with the subject of my paper I am forced to leave it.

What little I have said—and the process requires but little explanation—will lead you to see that the mercury process is one very rapid, easy of application, and accurate. There may be present in ordinary oil of vitriol every impurity ordinarily found without affecting the results.

I have found this process of especial use in the estimation of the nitrous acid in the waste acid from the aniline works. This waste acid at 116° T. has generally been sold on the basis of containing 3 to 4 per cent of nitrous and nitric acids. But on a thorough examination of this acid from several works, though the permanganate process shows 3 to 4 per cent, yet the mercury process scarcely shows 1 per cent.

In 1872, when Dr. John Watts wrote me upon the subject, I sent him some samples which I had previously examined by the permanganate process, and he returned me the following results:—

	Vol. N_2O_2 Roughly.	Vol. N_2O_3 Accurately.	Per cent Davis.	Per cent. Watts.	Difference.
1.	11·48	11·44	{1·229 / 1·204}	1·138	0·079
2.	10·62	10·72	1·156	1·059	0·097
3.	9·25	9·18	1·000	0·920	0·080
4.	12·25	12·25	1·263	1·229	0·034

Three analyses of the same samples gave—

I.	II.	III.	IV.
11·65	10·77	9·20	12·25
11·46	10·60	9·25	12·20
11·34	10·50	9·30	12·30

These results, which I received in 1872, were followed up by some made by myself upon vitriol made from Mason's ore, which were as follows:—

	Sp. Gr.	P.c. N_2O_3 Permanganate.	P.c. N_2O_3 Mercury.
From absorber	1·75	1·742	1·688
From concentrator ..	1·71	0·142	—
Chamber acid used ..	1·57	0·092	0·023
Leading chamber 1 ..	1·56	0·092	0·027
,, 2 ..	1·55	0·068	0·012
,, 3 ..	1·45	0·144	0·146
,, 4 ..	1·45	0·031	0·036
,, 5 ..	1·40	0·049	0·062
Exit chamber 6 ..	1·35	0·042	0·083

Here we have the same results as in the spent oxide acid. The arsenious acid deoxidises the permanganate in the first two chambers, in Nos. 3 and 4 the nitrous acid exists unoxidised, whilst in Nos. 5 and 6 there exists both nitrous and nitric acids.

In 1877 I obtained the following results from oil of vitriol made from Rio Tinto ore:—

	Sp. Gr.	P.c. N_2O_3 Permanganate.	P.c. N_2O_3 Mercury.	Per cent. As_2O_3.
From absorber ..	1·745	0·631	0·614	0·437
From concentrator	1·745	0·206	0·009	0·542
Leading chamber 1	1·665	0·125	0·032	0·192
,, 2	1·645	0·219	0·207	0·093
,, 3	1·620	0·305	0·315	0·005
,, 4	1·570	0·140	0·187	trace
,, 5	1·535	0·113	0·110	,,
,, 6	1·505	0·189	0·226	,,
Exit chamber 7	1·595	1·441	1·504	,,

Nitric acid is found again in the last two chambers, and it will be noticed how nearly the permanganate results agree with the actual amounts of nitrogen oxides found, so that it would seem that there are no other compounds capable of being oxidised than the nitrous acid in the nitro-sulphuric acid from the Gay-Lussac absorbing column, and that the method of oxidation by either the permanganate or bichromate is allowable in this case; but I hope to treat of this more fully in a paper I am preparing to read shortly upon "Nitric Acid in the Vitriol Manufacture, and where does it go to?'

Barton Arcade, Manchester,
December 19, 1877.

ON THE

LAW OF THE ABSORPTION OF RADIATIONS ACROSS BODIES,

AND OF

ITS APPLICATION IN QUANTITATIVE SPECTRAL ANALYSIS.

By M. G. GOVI.

Part I.

If an absorbent medium is interposed in the path of the white light which passes by the slit of the spectroscope, we generally see obscure bands appear in different parts of the spectrum, which diminish the brightness of the colours and even extinguish them completely. It is very rare that these bands do not encroach upon a large number of the lengths of contiguous waves. If we

augment the thickness of the absorbent medium we often see new shaded bands appear between the former, but there invariably occurs a deepening and a progressive dilatation of the first bands, so that for a certain thickness of the medium the whole spectrum is invaded by the shadow and enfeebled to such an extent that it may be regarded as altogether extinct.

This progressive enlargement of the absorption-bands strikingly recalls the increase in number, and the dilatation of the luminous rays, which many observers have remarked in the spectra of incandescent gases in proportion as their rarefaction is diminished and their temperature increased. All the rays of the spectrum, visible and invisible, present analogous phenomena, and if only the luminous rays are mentioned here it is because their study is more convenient and more general than that of the ultra-red or ultra-violet radiations.

It is easy to see that the absorbent power of any substance is not sufficiently characterised by the appearance of such or such a dark band in the spectrum of white light which has traversed such or such a thickness of it. It is needful to know all the modifications which it may produce in the spectrum from the feeblest and the most limited up to that which produces the apparent extinction of all radiation.

To observe directly spectral curves of equal absorption it is sufficient to give to the absorbent bodies the form of a prism, more or less acute, which is applied by one of its plane surfaces against the slit of the spectroscope. The edge of the prism is placed at one of the ends of the slit, parallel to its width, and there is thus obtained, over the whole length of the aperture, an absorbent medium, the thickness of which increases uniformly from zero (at the place of the angle) up to a certain maximum, which depends on the angle of the prism and on the length of the slit. The deviation due to the prismatic form of the medium may be destroyed by opposing to the first prism a second, of a material as little absorbent as possible, such as rock-salt, fluor-spar, quartz, glass, water, or alcohol, &c. The angle of the second prism is easily calculated by approximation, but, in case of need, it may be rendered variable within limits sufficiently wide to ensure a compensation almost perfect.

If we place in this manner an absorbent medium of variable thickness before the slit of a spectroscope illuminated by perfectly white light, *i.e.*, the light of incandescent solid bodies, the spectrum no longer appears, as ordinarily, uniformly luminous in all its height, but we distinguish in it shadows, more or less undulated or denticulated, which represent to the eye the law, according to which the coefficient of absorption of the medium varies with the wave-length of the incident light. If we divide the slit into two parts in the direction of its length, and employ each of these two parts to produce a spectrum with curves of chromatic absorption, the two spectra will be found in juxtaposition in the direction of their length, and it will be easy to compare the curves and recognise their equality or their differences. We may even by a very simple artifice cause two spectra of one and the same absorbent medium in two different degrees of concentration to slide one over the other, recognising thus zone of equal intensity, and thus apply the spectroscope to the quantitative determination of the substance used as a medium.—*Comptes Rendus.*

SUSPENSION, SOLUTION, AND CHEMICAL COMBINATION.*

By WILLIAM DURHAM, F.R.S.E.

SOME time ago I made some experiments on "suspension of clay" in water, in acid, and in saline solutions. These formed the subject of several communications to the Royal Physical Society of Edinburgh, and an abstract was afterwards published in the CHEMICAL NEWS. I shall describe some of these experiments as an introduction to this paper.

1. *Clay in Water.*—A few grains of fine white clay were stirred up in about a pint of pure water, in a glass jar. The time which the water took to clear, and the clay to deposit itself in the jar, was noted, and found to be about thirty hours.

2. *Clay in Acid Solutions.*—To a similar quantity of clay and water were added a few drops of acid, and the time of clearing again noted. In this case the time was from half an hour to one hour, according to the quantity of acid used.

3. *Clay in Salt Solutions.*—In place of acids, salts of various kinds were added to the clay and water, and the effect in every case was to shorten the time of precipitation of the clay, according to the kind and quantity of the salt used.

In endeavouring to ascertain the cause of these phenomena I was led to experiment on various solutions, and obtained results which appear to me very interesting and to open up a line of research likely to lead to important results as to the laws of solution and chemical affinity. The following are the more important facts as yet determined:—

1. NaCl and HCl.—To a saturated solution of sodium chloride was added strong hydrochloric acid. Salt was rapidly precipitated on each addition of acid. This action is usually described as sodium chloride is insoluble in hydrochloric acid, but the mode of action does not seem to have attracted much attention. The following experiments throw some light on the matter:—

2. $Na_2SO_4+10H_2O$ and HCl.—To a saturated solution in water of sodium sulphate was added strong hydrochloric acid. *Anhydrous* sodium sulphate was precipitated. The precipitate was immediately dissolved on a further addition of hydrochloric acid. In this case it cannot be said that anhydrous sodium sulphate is insoluble in hydrochloric acid, as it easily dissolves in excess of acid. The action seems analogous to what occurs when ammonia is added to a zinc salt. Zinc oxide is first precipitated, and then dissolved again as excess of ammonia is added. The next experiment makes the action more apparent.

3. Crystals of $Na_2SO_4+10H_2O$ and HCl.—Strong hydrochloric acid was poured over some crystals of sodium sulphate. The crystals were rapidly broken up, the water uniting with the hydrochloric acid, while the anhydrous salt was left undissolved. As in No. 2, however, on the addition of excess of acid, the anhydrous salt was at once dissolved.

4. $CaCl_2$ and HCl.—To a saturated solution in water of calcium chloride was added some strong hydrochloric acid. No action was apparent. As calcium chloride has a great affinity for water, I concluded that the affinities were balanced in the two solutions, and therefore there was no apparent action. To prove this, I added to the hydrochloric solution some fragments of solid calcium chloride, which, as anticipated, rapidly dissolved with effervescence, expelling hydrochloric acid gas copiously.

5. A weighed quantity of solid calcium chloride was dissolved in a measured quantity of water, and the rise in temperature noted: this was 15° F.

6. The same quantity of solid calcium chloride was added to strong hydrochloric acid, and the rise in temperature also noted: this was 6° F., being a difference of 9°, accounted for, no doubt, by the vapourising of the HCl gas expelled in the latter case.

7. NaCl and $CaCl_2$.—Calcium chloride, both in saturated solution and solid, was added to saturated solution of sodium chloride, and in both cases the sodium salt was precipitated, the calcium chloride taking its place in solution.

8. HCl and H_2SO_4.—Strong sulphuric acid was added to strong hydrochloric acid when the latter as gas was expelled with effervescence.

* From a Paper read to the Royal Society of Edinburgh, January 21st 18

9. $CaSO_4$, HCl, and H_2SO_4.—Strong sulphuric acid was added to a saturated solution of calcium sulphate in hydrochloric acid. Calcium sulphate was precipitated and hydrochloric acid gas expelled. I next looked for two solvents which would dissolve the same substance and yet precipitate it when mixed. These results I found with sulphuric acid, water, and calcium sulphate, thus:—

10. Two solutions (saturated) of calcium sulphate, one in water and one in sulphuric acid, were mixed. Calcium sulphate was deposited on cooling.

11. $CaSO_4$ in Water, and H_2SO_4.—To a saturated solution of calcium sulphate in water, sulphuric acid was added. Calcium sulphate was precipitated on cooling.

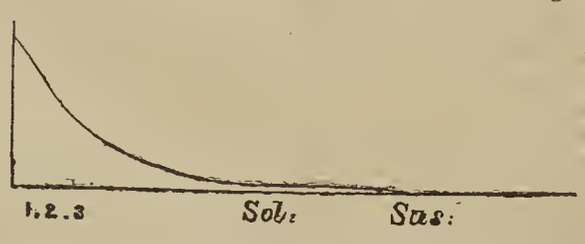
12. $CaSO_4$ in H_2SO_4 and Water.—To a saturated solution of calcium sulphate in sulphuric acid, water was added. Calcium sulphate was precipitated on cooling.

Three experiments, similar to Nos. 10, 11, and 12, were performed, only substituting clay in suspension for calcium sulphate in solution, and the results were similar. Clay in strong sulphuric acid was suspended nearly as long as in water, but on mixing the liquids, or on adding sulphuric acid to the water, or water to the sulphuric acid, the precipitation of the clay was greatly accelerated. Experiments 10, 11, and 12 seem to indicate that there is a point on one side of which water affinity is in excess, and on the other side sulphuric acid affinity.

I hope to extend these experiments to other substances than those already operated upon, and to enter more minutely into the various phenomena. So far as they go, however, they seem to point to certain conclusions which are interesting and suggestive:—

(1). *There seems to be a regular gradation of chemical attraction, from that exhibited in the suspension of clay in water up to that exhibited in the attraction of sulphuric acid for water, which we call chemical affinity.* The attraction between water and clay is neutralised by the stronger attraction between water and salts in solution. The latter, in its turn, is neutralised by the attraction between water and hydrochloric acid, which *almost* reaches the strength of a definite chemical compound. Then, finally, we reach water and sulphuric acid, which neutralise all the foregoing attractions and form more than one definite chemical compound.

(2). *That chemical combinations, solutions, and suspension differ only in degree, and are manifestations of the same force and definite chemical compounds, are just the points where the affinity exerts force enough to hold an exact number of atoms with a certain strength.* Chemical affinity should be studied in this connection as a regularly increasing force represented in the usual way by co-ordinates. For example, sulphuric anhydride, SO_3, might be represented by some such curve as the following:—



where 1 would represent the force by which 1 molecule of H_2O was held; 2 and 3 the force by which 2 and 3 molecules of H_2O were held. Sol.: the strength of attraction between SO_3 and H_2O, which prevents solution (say) of $CaSO_4$; and Sus.: the strength which prevents clay being held in suspension.

(3). *The attraction of chemical affinity is not, in every case at least, exhausted when a definite compound is formed, but has sufficient power left to form solution or suspension compounds.* Thus calcium sulphate is a definite chemical compound, but it still possesses sufficient affinity for sulphuric acid to enter into solution with it. This view might explain the researches of M. Stas on atomic weight. If he be correct he proved that Prout's law—that "the atomic weights of the elements are simple multiples of that of hydrogen"—is not correct, though very nearly so, the differences being very small. If it be true that the attraction of affinity is not entirely exhausted in a definite compound, but that there is a fraction of it, so to speak, to spare, we should only find Prout's law to hold good if we could analyse 1 molecule of any compound; but as in any analysis we can make there must be many molecules, each atom of these molecules having a fraction of its affinity for another atom to spare, these fractions would unite and hold in combination an extra number of the other atoms,—not so firmly perhaps, but still firmly enough to make the whole appear a definite compound on analysis; and this would affect the calculation for atomic weight. Thus suppose 2 atoms of Cl = 71 combine with 1 atom of Ca = 40, and still have 1-100th part of affinity to spare, then 200 atoms of Cl would take up 101 atoms of Ca, and from this analysis we should make the atomic weight of Ca not 40, but 40·4.

(4). *If chemical combination and solution are due to the same force, then solution will loosen the combination by spreading the affinity*, and possibly there may be a rearrangement of the soluble and solvent analogous to what is known to take place when two salts, having different acids and bases, are mixed. Thus, it appears to me, a drop or two of sulphuric acid added to a pint of water spreads its affinity equally through the whole pint of water; and this is the force which compels the water to drop or precipitate the clay. It further seems to loosen slightly the affinity of the H and O in the water, so that they are easier separated, as shown in the conduction of electricity. As more acid is added the effect is increased, until a point is reached where the quantity of water is no longer sufficient completely to neutralise the affinity of the sulphuric anhydride, which is shown by such phenomena as solution of $CaSO_4$ and increased resistance to electric conduction, because the SO_3 has begun to draw to itself more strongly the elements of the water, as its action is now concentrated on a smaller quantity.

If these views prove to be correct, many phenomena at present obscure would be readily explained.

ON THE

PRESENCE OF OXYGEN IN THE BESSEMER METAL.

By SERGIUS KERN, M.E. St. Petersburg.

In a late number of the CHEM. NEWS (vol. xxxvii., p. 20 a method was proposed by the author for the estimation of oxygen in steels. An account of some new experiments on the same subject may be of use to metallurgists.

One thousand grms. of the Bessemer metal, taken out of the retort just before the addition of spiegeleisen, was cast in a small cast-iron mould. The casting was divided into two pieces: one of them was strongly hammered in a heated state; the second piece was left in its original form. The two specimens were tested for oxygen separately, by the method described in a former article on the same subject. It may be of use if I describe shortly an improved apparatus used for this purpose.

A strong porcelain tube, 0·250 metre long and 0·025 to 0·050 metre in diameter, was filled with 100 grms. of the specimen and placed in a long fire-clay furnace, heated by coke. Through the tube, during the ignition, nitrogen was passed, produced by heating ammonium nitrite (NH_4NO_2). The gas before entering the combustion-tube was well dried: this was executed by passing the current of gas, first, through a tube containing asbestos moistened with sulphuric acid, and, secondly, through a tube with fused calcium chloride. The gas liberated from the com-

bustion-tube with the nitrogen passes first through an U tube, containing a concentrated solution of potassium hydroxide (KHO) in pure ethyl alcohol, in order to absorb the carbonic acid and oxide (CO_2,CO) which may be present in the cast metal, as shown by the well-known experiments of Troost and Hautefeuille (*Comptes Rendus*, t. lxxvi., p. 562). From the ethyl alcohol tube the gas is lastly passed through a potash apparatus containing a concentrated solution of pyrogallic acid, $[C_6H_3(HO)_3]$, in water, in which is dissolved 20 to 25 per cent of potassium hydroxide. The ignition of the specimen must be continued for twenty hours, and the potash-apparatus is then quickly weighed; the increase in weight of the apparatus shows directly the percentage of oxygen.

The following are the results of my experiments :—

Hammered Specimen.

Experiment 1 :—

	Grms.
Weight of the potash-apparatus after combustion	64·817
Ditto before combustion	64·652
Difference	0·165

Experiment 2 :—

Weight of the potash-apparatus after combustion	64·829
Ditto before combustion	64·667
Difference	0·162

Non-hammered Specimen.

Experiment 1 :—

	Grms.
Weight of the potash-apparatus after combustion	66·408
Ditto before combustion	66·223
Difference	0·185

Experiment 2 :—

Weight of the potash-apparatus after combustion	66·735
Ditto before combustion	66·564
Difference	0·171

These specimens contain less oxygen than the samples analyses of which were given in a former article. Of course it is impossible to suppose that oxygen combines with steel in constant quantities, because the longer the blowing process is continued after the carbon of the metal in the converter (Bessemer apparatus) has been consumed, the greater percentage of oxygen may occlude in the refined metal.

Analysing an inferior steel rail, Mr. J. B. Britton, U.S.A., found 0·760: such metal, which we call burnt steel, is of no use whatever for manufacturing purposes.

Obouchoff Steel Works.

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, January 8, 1877.

E. W. BINNEY, F.R.S., F.G.S., President, in the Chair.

THE PRESIDENT said that on the 31st of December last, at about 5.30 p.m., he was walking from Ainsworth to Bury, and he observed a large meteor which started from the star Pollux, and after making a slight curve upwards disappeared near the star Beta in Taurus. It seemed larger than the planet Venus, then brightly shining, and was of a yellowish white colour, and disappeared without breaking. It left a luminous track of its entire course for a short time after it had passed.

"*Note on the Decomposition of Water by Iron Pyrites*," by C. A. BURGHARDT, Ph.D. I have recently endeavoured to ascertain what part iron pyrites plays in the formation of the natural sulphides of other metals, such as copper glance, copper pyrites, &c. These and other sulphides are supposed to arise through the reduction of the corresponding *sulphates* of those metals by organic matter. Bischoff, in his "Chemical and Physical Geology," vol. iii., p. 554, says, "The production of sulphides presupposes the existence of sulphates; and the elimination of sulphur from sulphates, either in combination with hydrogen, or with the metals of the alkalies, or alkaline earths, presupposes the existence of organic life, since that effect would be produced only by carbonaceous substances. The influence of organic substances in the production of sulphides is further shown by the fossil remains, consisting of iron pyrites, blende, copper pyrites, variegated copper pyrites, sulphide of copper, and cinnabar." This theory appeared to me to be open to serious objections, as it would be very difficult to show the presence of organic matter in many crystalline rocks sufficient to produce the large sulphide formations often occurring in them through the reduction of sulphates. I therefore desired to ascertain whether sulphuretted hydrogen could be produced by simpler means, and in accordance with the occurrence of sulphides in rocks *free from organic matter*. With this view I placed some pure finely-powdered iron pyrites into a glass tube, covered it with perfectly pure distilled water (previously well boiled in order to drive out any air dissolved in it), placed the tube and its contents in a vessel containing boiling water, heated it gently for a short time to drive out any air which might have been contained in the tube, and sealed the latter up. After heating the above in an air-bath for four days, at a temperature of about 120° C., the tube was opened, when a very strong smell of sulphuretted hydrogen was instantly perceived, and proved to be present by its chemical reactions. The liquid contents of the tube were analysed, and found to consist of ferric sulphate, ferrous sulphate, and free sulphuric acid, whilst there was a slight deposit of ferric oxide upon the sides of the glass tube. This experiment certainly proves that sulphuretted hydrogen can be produced in the interior of the earth *without* the presence of organic matter, as all rocks (both crystalline and sedimentary) contain more or less iron pyrites disseminated throughout them, and are also saturated with water. I hope soon to determine quantitatively the reaction which occurs in the above experiment.

NOTICES OF BOOKS.

Annual Report of the Board of Regents of the Smithsonian Institution. Washington: Government Printing Office, 1877.

IN addition to the usual yearly reports of the Institution this volume contains a eulogy on Gay-Lussac, delivered by Arago, interesting without doubt, but which would have been much more valuable a quarter of a century ago. The researches and discoveries of the illustrious French chemist require no recapitulation, but the discourse contains some interesting incidents connected with his life. When travelling in Italy in company with Humboldt and Von Buch, he met at Naples strange treatment from a man who unfortunately bears an English name, a certain Dr. Thompson. "When they presented themselves, accompanied by a Neapolitan scientist, to study his museum, he addressed them in these outrageous words:

'Separate yourselves, gentlemen, I can keep my eyes on two, but not upon four." One feels tempted to ask in what society of Lazzaroni had Dr. Thompson borrowed sentiments so low and language so indecent; but all is explained when we learn that Thompson was the physician, friend, and confidential agent of General Acton, the instigator of the political assassinations which defiled Naples at the close of the last century." With all submission to Arago we think that more explanation is urgently needed.

In his celebrated balloon-ascent, the first undertaken from purely scientific motives, he reached the height of 23,000 feet, an elevation then perfectly unrivalled. "Having risen to 7000 metres he was desirous to soar still higher, and for this purpose rid himself of every article not absolutely needful. Among these was a white wooden chair, which fell by chance into a bush, near a girl guarding some sheep. What was the astonishment of the shepherdess? as Florian might have said. The sky was pure, the balloon invisible. How explain the chair if it came not from paradise? The only argument against this conjecture was the coarseness of the work; the workmen, said sceptics, must be very unskilful above. The dispute was at this point when the journals, publishing an account of Gay-Lussac's voyage, put an end to it, and classed among natural effects what had until then been regarded as a miracle."

At Milan Gay-Lussac and his fellow travellers found the scientific world much excited by the announcement of the pretended discovery of Configliachi that water was composed of muriatic acid and soda! On consulting Volta, the eminent electrician replied: "I have seen the experiment, but I do not believe in it." This dictum, Arago remarks, might occasionally find valuable application.

We are told that at the end of the eighteenth century no one was considered a real physicist unless possessing a valuable collection of instruments well polished, well varnished, and arranged in glass cases. It was not without trouble that Gay-Lussac, who owned only a few instruments of research, succeeded in overcoming this prejudice.

The delay of the French Government in creating him a peer meets with an amusing explanation. The "dispensers of royal favour" had no fault to find with his personal eminence, with his connections, or his character. "They acknowledged softly, very gently, shrouding themselves in mystery, as if ashamed of such an avowal, that the great chemist worked every morning with his own hands in the assay-office, which seemed incompatible with the dignity of a peer of France!" Had it been his lot, however, to have been born in England, even had he been far more eminent than he really was, such a thing as his elevation to the peerage would never even have been mooted. Gay-Lussac was several times wounded in the course of his researches. He was once nearly blinded, and on another occasion received an injury in the hand, which it is intimated ultimately led to the disease of which he died. His unfinished "Philosophie Chimique" he unfortunately ordered to be destroyed.

Pollen. By M. Pakenham Edgeworth, F.L.S., F.A.S. London: Hardwicke and Bogue.

The author mentions that two years ago Mr. Airey published some observations on the dust collected by exposing to the air plates of glass smeared with some glutinous substance, and mentioned that among this dust were grains of pollen. The author who had long ago examined and drawn a number of specimens resumed the subject, enquiring into the forms of pollen likely to be diffused in the air, and thence proceeding to discover all he could about pollen. He has thus produced a monograph utterly "unreadable," but at the same time exceedingly useful as a work of reference for botanists and for all who take an interest in the nature and properties of the microscopic solids suspended in the atmosphere. The bulk of the work is devoted to a catalogue of the plants whose pollen has been examined by the author or by his predecessors in the same field, and with references to the plates which contain 446 figures, all drawn to scale, so as to enable the student to ascertain the actual size of the specimen in every case. The bibliography of the subject is also given.

Among the general conclusions which the author deduces from his investigations we find it remarked that in some botanical families the species vary greatly in the shape and size of their pollen grains, whilst in others they are almost always the same. Hence, the value of a consideration of these grains in studying the affinities and position of a plant fluctuates greatly. In size the grains differ also widely. Some, as in the Malvaceæ, *Cobea*, and some species of *Iris*, being as much as 1-100th of an inch in diameter, and consequently visible to the naked eye. In many Primulaceæ, Melastomaceæ, Borragineæ, &c., they do not exceed 1½ to 2-600oths of an inch. Their colour is mostly yellow or white, but the author has met with blue, red, brown, and even green pollen, a fact which Lindley has denied. In three or four instances only he has found two or three different forms of pollen produced by the same anther. In *Mimulus luteus* he has found the simple form common in the Scrophulariaceæ, mixed with a coiled form. The simplest form—that of a bag with one slit—is seen in the *Magnolia* and the *Nuphar*, the author here remarking, "it is curious that the simplest pollen should be found in one of the most ornate and largest of flowers.

CORRESPONDENCE.

AROMA OF BUTTER.

To the Editor of the Chemical News.

Sir,—An abstract from *Les Mondes* (Chemical News, vol. xxxvii., p. 31), in reference to the aroma of butter, mentions the use of *Asperula* and other herbs in the churn for the purpose of imparting the aroma of mountain growth. Permit me to remark on this that the flavour would be unpleasant to the public, whose taste has been otherwise trained; by carrot-juice, churning-salts (nitre), annotto, and other special nostrums.

I have observed that in many parts of Switzerland, noted for their good milk and superior butter, a simple and, I think, a valuable method of not only bestowing a fine aroma, but of removing any *gouty* or *sweaty* odour from the milk, is in regular use there. The milk, as soon as it is drawn and whilst warm, is filtered through a sprig of washed fir-tips, the stem inserted loosely and upright into the hole of a funnel. The milk being poured on this bunch of clean spicular leaves, deposits hairs, skins, clots, or gelatinous sliminess, as the case may be, on the little spikes. A fresh sprig is used at each milking. The milk that drains is clean, and especially of a fresh flavour, or so slightly aromatised as to retain no unpleasant resinous odour; but becoming as it were "cured," it does not turn sour as soon as milk strained through wire-gauze. Horse-hair strainers are difficult to keep sweet; they often propagate decay by the film of animal matter which they retain, especially close to the joints of the wood. No insects are ever found in fir-tips, whilst *Asperula* and many other herbs occasionally abound in them, and they cannot be used in winter except in the dry state, when their odours are mostly gone. The fir-tips are rinsed only to remove dust; they are obtainable fresh even during winter, as the fir is an evergreen.—I am, &c.,

F. Trachsel.

Church, near Accrington, Jan. 19, 1878.

THE INSTITUTE OF CHEMISTRY.

To the Editor of the Chemical News.

Sir,—The objection which I and other chemists have to the Institute is that it is not calculated to do any appreciable good, either to the public or to the general body of chemists; more than that, under its present auspices it bids fair to become a very sinister organisation, and, with the experience of fifteen years of professional life in London, I warn the younger members of my profession to hold aloof from the Institute.

If corporate action among English chemists can effect anything good, it can reform the Chemical Society; and until that Society has been put into a reputable condition all efforts at organisation must prove abortive.

From Mr. Groves's letter of December 21st, 1877 (Chem. News, vol. xxxvi., p. 274), it appears that more than three hundred persons had been elected Fellows of the Institute. As this statement was evidently made to induce others to join, it ought to have been coupled with information as to how many had accepted the election. Within my own knowledge several chemists have declined.—I am, &c.,

J. Alfred Wanklyn.

January 28, 1878.

THE INSTITUTE OF CHEMISTRY.

To the Editor of the Chemical News.

Sir,—Many chemists will, doubtless, in the main, agree with the remarks of your correspondent "Well-wisher" on the new Institute. I cannot but think, however, that his strictures upon those who have not received that "training" he himself has been sufficiently fortunate to enjoy are somewhat too severe. "Unqualified humbugs," "bottle-washers," and "druggists who undertake to do analytical work in the intervals of making pills and lotions," are uncharitable and uncalled-for expressions. "Well-wisher" must have forgotten that history records more than a solitary instance of a man who has raised himself to the very highest rank in science, but who, nevertheless, started life as one of those "druggists" he so contemptuously alludes to. Cannot "Well-wisher" call to mind many men of science amongst us who are also engaged in trading pursuits? Moreover, is it not a fact that in the Council mentioned by Mr. Groves there occurs the name of at least one who is a "druggist," and a West-End *pharmacist*, as the modern expression has it, and who, it is said, has been actively engaged in developing the "Institute," but whose original contributions to science have *not* been, so far as I know, of a startling character? For aught I know there may be more than one of this very Council who commenced their career as "druggists," and received their early training "in the intervals of making pills and lotions"—if so, it is much to their credit. Certainly the "druggists" are not badly represented, as there are several gentlemen on the Council very closely connected with the trade.

But those chemists who think and feel with "Well-wisher" can hardly be expected to accept the courteous invitation of the Council, through Mr. Groves, to send certificates and details of training to a Council so composed. In common with many others I very much regret that so much needless secrecy has been observed in the promotion of the "Institute," and still further regret that the originators should have given way to so much narrow-mindedness and apparent "cliqueism" as the secret election of three hundred members betrays.

In my opinion every man, whether he be "druggist," "bottle-washer," or tinker, who can show by his *published original work*—not by certificate, and so forth—that he is worthy of the distinction ought to have the right to join the Institute, and of companionship with his scientific brethren. Until this is acknowledged, and acted upon openly and without favour, the Institute cannot hope to take deep root, or acquire the vigorous growth necessary to a permanent institution.—I am, &c.,

Justitia.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 26, December 24, 1877.

Indices of the Ordinary and Extraordinary Refraction of Quartz for Rays of different Wave-lengths as far as the extreme Ultra-Violet.—E. Sarasin.—The author states that the extreme ultra-violet spectra can scarcely be studied without apparatus fitted with prisms and lenses of quartz, since it is transparent for all radiations, even the most refrangible hitherto observed, whilst the different kinds of glass absorb the greatest part of these radiations, and even Iceland spar is not absolutely transparent for the extreme rays. A knowledge of the indices of refraction of quartz for these different radiations is therefore an essential element in the study of the ultra-violet spectra. He has therefore prepared a table of the indices of refraction of quartz, both for the ordinary and extraordinary ray.

Engraving on Glass by means of Electricity.—G. Planté.—The surface of a plate of glass is covered with a concentrated solution of potassium nitrate. Into the fluid layer thus covering the glass is plunged a horizontal platinum wire, running along the edges of the plate, and communicating with the pole of a secondary battery of 50 to 60 elements. The other electrode—formed also of a platinum wire, surrounded, except at its point, with a non-conducting substance—is taken in the hand, and with its point characters or designs are traced on the glass. A stronger current is required to engrave with the negative electrode.

Gazzetta Chimica Italiana.
Fasc. x., 1877.

Dilatation of Fused Sulphur.—Dr. S. Scichilone.—The results obtained by Prof. Pisati not agreeing exactly with those of Montessier, the author examines if this discrepancy is due to the condition of the sulphur. He finds that sulphur precipitated from sodic hyposulphite, and purified by repeated crystallisations from bisulphide of carbon, behaves exactly like natural sulphnr. On carrying the heating up to 440° he found, for the coefficient of dilatation, values substantially identical with those of Montessier.

On the Molybdenite of Biellese.—A. Cossa.—The author found, on analysis, —

Molybdenum	58·23	59·05
Sulphur	41·36	41·17
	99·59	100·22

The mean specific gravity of the mineral is 4·704.

An Experiment on Betulin.—E. Paterno and P. Spica.—The authors, on distilling betulin with anhydrous phosphoric acid, obtained an oily liquid, boiling between 245° and 250°, and having the composition—

Carbon	89·23
Hydrogen	10·74
	99·97

Ammoniacal Derivatives of Chloral.—R. Schiff and

G. Tassinari.—The authors examine the action of anhydrous acetic acid and butyl-chloral ammonium, of acetamid and butyl-chloral ammonium, of benzamid and butyl-chloral ammonium, of urea and butyl-chloral ammonium, of acetamid and bromal ammonium, and of the aldehyds upon chloral ammonium.

Maturation of Grapes gathered before Ripeness.—E. Pollacci.—The author finds that grapes plucked when unripe continue to mature as the proportion of sugar gradually increases, while that of acid diminishes.

Contribution to the Study of the Tannin contained in Ilex Paraguayensis.—P. N. Arata.—A detailed comparison of the behaviour of the tannin of "Maté," or Paraguay tea, with caffeo-tannic acid.

Moniteur Scientifique Quesneville.
January, 1878.

Process for Determining the Vapour-Density of Bodies Boiling at Elevated Temperatures.—Victor Meyer.—Taken from the *Berichte der Deut. Chem. Gesell.*, ix., 1216.

Cyclamin, Primulin, and Primula-camphor.—Dr. Mutschler.—From *Liebig's Annalen*, February, 1877.

Hydrogenisation of Benzol and of the Aromatic Compounds (M. Berthelot's Recent Resarches).—E. Noelting.—The author remarks that according to the formula of Kekulé in the bisubstituted derivatives, only three isomers are possible, whilst according to that of Berthelot there should be four. He does not, however, undertake to decide.

Azoic Colouring Matters.—E. Noelting.—A brief sketch of the history of this class of dyes, from Bismarck brown to chrysoidin.

History of Rosolic Acid, and on its Relations with Rosaniline.—R. von Wagner.—There is reason to believe that this acid derivative of phenol will one day form, as well as aniline, a point of departure for the manufacture of rosaniline and its derivatives. It is therefore important to know what is the actual state of our acquaintance with this acid. In 1833 Runge, in his classical researches on the principles contained in the oils of coal-tar, discovered three bases (cyanol, pyrrol, and leukol), and three acids (the carbolic, brunolic, and rosolic. Reichenbach contested the novelty of the discovery, and maintained that he had years ago isolated from the oils of beech-tar several of the bodies which Runge had now obtained from coal-tar. The first authorities of the epoch—Liebig, Poggendorf, and Mitscherlich—confirmed, however, the existence of the six bodies discovered by Runge. This controversy showed the characteristic distinction between the principles obtained respectively from wood-tar and coal-tar, and proved, further, that the base described by Runge as cyanol had been first obtained in 1826 by Unverdorben. Runge did not understand the relation existing between phenol and rosolic acid. He obtained it by boiling in water the residue from the distillation of carbolic acid, and adding acetic acid to the rose-coloured solution derived from the rosolate of lime formed. He also observed that rosolic acid was a true colouring principle, forming with certain mordants red colours and lakes of a beauty comparable to those of carthamin, cochineal, and madder. After describing the results—often conflicting—of the chemists who have since occupied themselves with rosolic acid, the author refers to the researches of Dale and Schorlemmer, who find that rosolic acid may be converted into rosaniline by the action of liquid ammonia at a temperature of 200°.

Modes of Formation of Acids in the Organism, and on certain properties of the Serum of the Blood.—Prof. R. Maly, of Gratz.—A lengthy treatise, taken from he *Sitzungs berichte* of the Imperial Academy of Sciences of Vienna for 1877. The author announces that hydrochloric acid is liberated by the reaction of the acid monobasic phosphate of soda upon the chlorides.

Nitrification by Organised Ferments.—MM. Th. Schlœsing and A. Muntz.—According to the experiments of the authors, whenever a nitrifiable medium is kept in presence of chloroform or heated to 100°, and then preserved from contact with atmospheric dust, nitrification is suspended, but it may be set up again by introducing a trace of earth in the act of nitrification.

Artificial Production of Corundum, Ruby, and of the various Crystalline Silicates.—MM. Fremy and Feil.—Already noticed.

Bulletin de la Societe Chimique de Paris,
No. 1, January 5, 1877.

Certain Melting-points.—M. Berthelot.—The author finds that crystalline phosphoric acid, PO_8H_3, melts at 41·75°, and re-solidifies at 40·5°. The slightest trace of an excess of water lowers the melting-point. Monohydrated nitric acid melts at −47°, and chloroform at −70°. Carbonic acid boils about −78·2°.

Heat of Neutralisation of Perchloric Acid.—M. Berthelot.—At 15° 100·5 grms. of diluted ClO_8H + 76·5 grms. of dilute BaO liberate +13·8.

Action of an Alcoholic Solution of Potassa upon Chloroform.—M. Berthelot.—The author had hoped to use the decomposition occasioned by this reaction for measuring the heat of the formation of chloroform from its elements, but found this impracticable, owing to the complications so frequent in organic reactions.

Liquid contained in a Very Ancient Glass Vase.—M. Berthelot.—A very lengthy notice of a liquid contained in a nodule in the stem of an ancient vase. On analysis it proved to be water which had dissolved small quantities of the constituents of the glass.

Remarks on M. Plicque's Note on Artificial Ultramarine.—E. Guimet.—The author asserts that M. Morel was the first to suggest and to make a selenium-ultramarine. He also declares that M. Plicque experimented, not partially, but solely at his expense.

Direct Manufacture of Soda and Potassa from their Chlorides.—G. Bohlig.—The author digests oxalate of magnesia with an equivalent of the alkaline chloride and hydrochloric acid, according to the equation —

$$C_2O_4Mg + HCl + NaCl = C_2O_4HNa + MgCl_2.$$

Magnesium chloride remains in solution, whilst acid sodium oxalate separates in crystals. These are washed in a little water, and introduced into an autoclave with a corresponding quantity of magnesian carbonate and water. Carbonic acid is at first disengaged: when it has expelled the air the autoclave is shut, and the mass worked up with an agitator. The pressure rises at first to two atmospheres, falling again to nothing. The products of the reaction then consist in a strong solution of sodium bicarbonate and magnesian oxalate, compact and crystalline. The solution of bicarbonate is boiled with magnesia (obtained by the decomposition of magnesium chloride by heat), when carbonate of magnesia is precipitated, and neutral carbonate of soda remains in solution.

Reimann's Färber Zeitung,
No. 47, 1877.

This issue contains nothing of general interest.

Sewage Treatment.—At the last meeting of the Aylesbury Local Board of Health it was unanimously resolved—"That the Board are perfectly satisfied with the manner in which the Sewage of the District has been treated by the Native Guano Company."

COMPOSITION AND QUALITY OF THE METROPOLITAN WATER.

DECEMBER, 1877.

THE following are the returns of the Society of Medical Officers of Health:—

	Appearance in 2 foot Tube.	Ammonia. Saline.	Ammonia. Organic.	Nitrogen as Nitrates, &c.	Oxygen used to Oxidise Organic Matter.	Total Solids.	Lime.	Magnesia.	Chlorine.	Sulphuric Anhydride.	Hardness on Clark's Scale. Before Boiling.	Hardness on Clark's Scale. After Boiling.
		Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs
Thames Water Companies.												
Grand Junction	Slightly turbid	0·000	0·008	0·120	0·134	19·20	7·450	0·500	0·87	1·730	12·6	3·70
West Middlesex	Clear	0·001	0·008	0·135	0·083	19·80	7·950	0·500	0·87	1·460	13·2	4·20
Southwark and Vauxhall	Clear	0·001	0·009	0·135	0·127	18·70	7·610	0·500	0·87	1·700	12·1	4·20
Chelsea	Clear	0·001	0·010	0·135	0·068	18·90	7·950	0·390	0·87	1·260	12·6	3·30
Lambeth	Clear	0·001	0·009	0·120	0·083	20·30	8·560	0·460	0·94	1·660	13·7	3·70
Other Companies.												
Kent	Clear	0·000	0·003	0·310	0·003	27·90	11·640	0·720	1·37	2·660	18·6	6·00
New River	Clear	0·000	0·007	0·150	0·036	20·20	9·070	0·360	0·87	0·930	14·3	3·30
East London	Clear	0·001	0·007	0·096	0·036	14·90	5·600	0·430	1·94	1·400	9·0	3·70

The quantities of the several constituents are stated in grains per imperial gallon.

NOTE.—The amount of oxygen required to oxidise the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the Metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it

C. MEYMOTT TIDY, M.B

NOTES AND QUERIES.

Manilla Rope.—Can any of your readers inform me of a mixture, used in the manufacture of Manilla rope, which will not evaporate or injure the colour, quality, or pliability of the rope?—ENQUIRER.

MEETINGS FOR THE WEEK.

SATURDAY, 2nd.—Physical, 3. "On Grove's Gas Battery," H. F. Morley, M.A., B.Sc. Annual General Meeting.
MONDAY, 4th.—Medical, 8.
—— London Institution, 5.
—— Royal Institution, 2. General Monthly Meeting.
—— Society of Arts, 8. "Explosions in Coal Mines," by Thomas Wills, F.C.S.
TUESDAY 5th.—Civil Engineers, 8.
—— Zoological, 8.30.
—— Royal Institution, 3. "Protoplasmic Theory of Life, and its Bearing on Physiology," Professor Garrod.
WEDNESDAY, 6th.—Society of Arts, 8. "Higher Commercial Education," John Yeats, LL.D.
—— Geological, 8.
—— Microscopical, 8. (Anniversary).
—— Pharmaceutical, 8.30.
THURSDAY, 7th.—Royal, 8.30.
—— Royal Institution, 3. "Chemistry of the Organic World," Prof. Dewar.
—— Chemical, 8. "Notes on the Tannins," Dr. Paul and Mr. Kingzett. "On a Method for the Determination of Boiling-Points," H. C. Jones. "The Alkaloids of the Aconite Family," Dr. Wright and Mr. Luff. "An Inquiry into the action of the Copper-zinc Couple on Alkaline Oxysalts," Dr. Gladstone and Mr. Tribe. "On the Estimation of Phosphorus in Iron and Steel," E. Riley.
FRIDAY 8th.—Royal Institution, 9. Weekly Meeting. "On Equality," Mr. Matthew Arnold.
—— Quekett Club, 8.
SATURDAY, 9th.—Royal Institution, 3. "Carthage and the Carthaginians," R. Bosworth Smith, M.A.

Now ready, 8vo., cloth, 30s.

PHOTOGRAPHED SPECTRA. One Hundred and Thirty-six Photographs of Metallic, Gaseous, and other Spectra, printed by the permanent autotype process, with Introduction, Description of Plates, and Index; and with an extra plate of the Solar Spectrum (showing bright lines), compared with the Air Spectrum, by J. RAND CAPRON, F.R.A.S.

London: E. and F. N. SPON, 46, Charing Cross.
New York: 446, Broome Street.

OFFICE FOR HOLLAND FOR CHEMICAL ANALYSES, NEW INVENTIONS, AND PATENTS,
146, Spuistraat, Amsterdam.
Branch in London.
Director—Dr. P. F. VON HAMEL ROOS.

TO BE SOLD.

A Practical, Experienced, and Advantageous Proceeding for the Fabrication of Cinnabar.—Apply to Td. 10, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London E.C.

Bar Magnets, 4 ins. by 3-8ths, 2s 6d. the pair. Ferrotype Discs, 1s. per pair. Box-wood Reels, wound with No. 36 wire, 3s. the pair. Binding-screws, 3s. the dozen. No. 36 Silk-covered Wire, 4s. the ¼ lb. Double-line Wire, 2d. per yard: best quality ditto, 3d. per yard. Flexible Silk Double-Wire Cord, 4d. and 8d. per yard. Small Electric Bells, 7s. 6d. each. Electric Call-Bell, with Key, Switch, and Battery complete, £3 the two sets; Magnetic ditto, £4 4s. Orders over 5s. post or carriage free; EDWARD PATERSON, Electric Bell Works, 3, Bedford Court, Covent Garden, W.C. Illustrated Catalogue for Two Stamps.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.
Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.
The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.
Especial facilities or persons preparing for Government and other examinations.
Private Pupils will find every convenience.
Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.
Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

J. I. HEADLY, ENGINEER, Cambridge, Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy 'Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

DO YOUR OWN PRINTING.

The "Optimus" Printing-Press for Amateurs. Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A. HERBERT, Printing Warehouse, 50, Finsbury Square, London, E.C.

WATER ANALYSIS.—Prof. WANKLYN, Lecturer on Chemistry and Physics at St. George's Hospital, Public Analyst for Buckinghamshire, Buckingham, High Wycombe, Peterborough, and Shrewsbury, has REMOVED to 7 Westminster Chambers, Victoria Street, S.W.

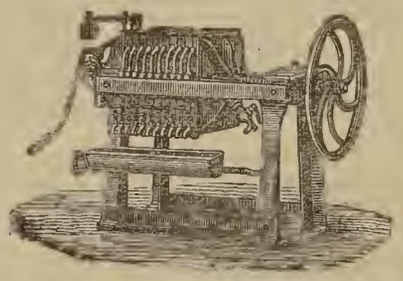
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

THE speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING, and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE — Lump, Crystallised, Ground, and Prepared. Large stock of every description. *** *Suitable for all Trades.*

ARSENIC — Refined powdered, Lump, Grey, and Ruby.

FLUOR-SPAR — Finest produced. Medium and Common for al purposes.

BARYTES — Carbonate and Sulphate. All qualities of Lump and Ground.

BAUXITE — Of high percentage of Alumina and low in Iron.

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,
MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

ERECTION OF PLANT.

TO SULPHATE OF AMMONIA MANUFACTURERS AND OTHERS.

STILLS, SATURATORS, and all APPARATUS in connection with the above Erected upon the Most Approved Plan—result of 15 years practical experience.—Address, G. Tunbridge, Man. Chem. Dept., Gas Works, Leicester, or J. Barnes, Plumber, &c., Barking, Essex.

THE CHEMICAL NEWS.

Vol. XXXVII. No. 950.

ON DYER'S CHEMICALS.

By J. MARZELL.

(Continued from p. 45.)

Dinitro-Benzol.

As crude material for this purpose either mono-nitro-benzol is taken, or it is started from benzol directly, without taking any notice of the intermediate formation of the mono-nitro-product. Following the first way, the usual process is to let mono-nitro-benzol slowly run into a mixture of nitric and sulphuric acid, and to purify the resulting product by washing and pressing.

But there are many reasons against this method in industry. The manufacture of mono-nitro-benzol as independent product requires treatments which can be neglected, the working up to dinitro-benzol being intended, *e.g.*, the washing out of the surplus acid, the distilling, &c. Therefore, in industry, benzol is by preference taken as a starting-point, treated with the mixture of acids in the same way as usual with the nitro-benzol, only the reaction is continued until the two NO_2 groups are substituted.

Referring to the mixture of acids, the opinions about the proportions between nitric and sulphuric acid are different. For laboratory works, equal portions are considered sufficient; but in working on a large scale a surplus of sulphuric acid is to be preferred. If we remember that in fact only the nitric acid is the reacting agent, whilst the sulphuric acid only acts by its hygroscopic qualities, that is to say, by absorbing the water delivered in the reaction it prevents the weakening of the nitric acid. Therefore, it is better, at all events, to take a little too much sulphuric acid than to run the risk of diminishing the yield and wasting the material. A proportion found as answering all practical purposes in working on a large scale would be—

100 NO_3H of 1·425 specific gravity.
150 H_2SO_4 of 1·843 ,, ,,

About the proportions between benzol and acids a small experiment will show that approximately. To a certain quantity of mixture of acids benzol from a known lot is added as long as it dissolves. In the end a little warming up will be of advantage. By comparing the remaining benzol, &c., a certain proportion will be given.

In the praxis the following proportions have proved to be practical:*—

100 parts benzol.
100 lbs. NO_3H of 1·425 sp. gr.
156 lbs. H_2SO_4 of 1·843 ,,

256 acid mixture.

The apparatus are the same as used in manufacturing mono-nitro-benzol, only they are plunged into an oil-bath. The benzol is put in, and the acid mixture admitted slowly, whilst the agitator is moving, and the refrigerator in work in the same way as with mono-nitro-benzol. If the first violent action is over, the agitator is stopped, and the mass allowed to settle. The weak acid is drawn off, and after that the operation taken up again with a fresh portion of acid. This time the liquors mix very easily, and the temperature just rises enough to keep the reaction going. If necessary a slight heat is applied. The operation may be considered finished if a sample of the oil swimming on the surface being taken solidifies in cooling. The dinitro-benzol is drawn off whilst it is hot and fluid, then it is washed, at first with hot, and then with cold water, and finally pressed.

The reactions taking place in the operation may be represented with the following figures:—

I. $C_6H_6 + NO_2OH = C_6H_5NO_2 + H_2O$.
II. $C_6H_5NO_2 + NO_2OH = C_6H_4(NO_2)_2 + H_2O$.

In this manner a dinitro-benzol is obtained of boiling-point 86° C.

β-Phenylen-diamine, $C_6H_4\{^{NH_2}_{NH_2}$.

This base was discovered in 1844 by Zinin,* who got it by the entire reduction of dinitro-benzol of b.p. 86° C., and characterised by A. W. Hofmann† in 1862.

The methods of producing it are various. The first and most important is that of Zinin's. Gerdemann‡ describes it thoroughly.

I. $C_6H_4\{^{NO_2}_{NO_2} + 6H = C_6H_4\{^{NH_2}_{NO_2} + 2H_2O$.

II. $C_6H_4\{^{NH_2}_{NO_2} + 6H = C_6H_4\{^{NH_2}_{NH_2} + 2H_2O$.

Mills got it by reducing the β-nitraniline with hydriodic acid. (This nitraniline appears in the first method as intermediate product.)

According to Martius and Griess‖ it is formed by acting upon amido-azo-benzol with reducing agent. Sn and HCl convert the amido-azo-benzol into aniline and β-phenylen-diamine of f.p. 63° C.

$$C_6H_5N=N-C_6H_4(NH_2) + 2H_2 = C_6H_5NH_2 + C_6H_4\{^{NH_2}_{NH_2}.$$

Th. Zincke and F. Sintenis§ treat the brom-dinitro-benzol, of temperature 72° C., with Sn and HCl. The two NO_2 groups are reduced, and the bromine atom is taken away.

$$C_6H_3\{^{NO_2}_{Br}_{NO_2} + 7H_2 = C_6H_4(NH_2)_2 + HBr + 7H_2O.$$

On the large scale only the first method has been adopted, and as reducing matters tin and hydrochloric acid are taken by preference (Gerdemann).

Manufacturing.

Into a mixture of 1 dinitro-benzol and 12 metallic Sn hydrochloric acid is added slowly, and in a fine stream. The reaction is a very violent one. In cooling crystals separate of chloro-stannite, $C_6H_8N_2(HCl)_2 + Sn_2Cl_4$, in white needles. This double salt treated with sulphuretted hydrogen yields the hydrochlorate of the phenylen-diamine, which is precipitated of its aqueous solution by a surplus of HCl. On decomposing this HCl salt with any alkali the free base is obtained. To recover the Sn,¶ throwing down with Zn is the best way. Sn is taken to produce the reduction, but it is precipitated as soon as it goes into solution. This is attained by means of adding Zn, as long as the reaction takes place resp. is going on.

The β-phenylen-diamine represents a di-acid base. The salts are crystallisable and soluble in water. Alkalies precipitate the base in an oily modification. In excess of ammonia it is dissolved with a brown colour, decomposition taking place. The base itself forms white crystals, however, getting brown in contact with the air. It crystallises very slowly, and if distilled it remains a long time liquid. The fusing-point is at 63° C., and the boiling-

* Wurtz, Matières Colorantes.

* *Journ f. Prakt. Chemie*, xxxiii., 34.
† *Proc. Roy. Soc.*, xi., 518.
‡ *Zeit. f. Analyt. Chemie*, 1865, 51.
‖ *Bull. de la Soc. Chim.*, vi., 158.
§ *Berichte der Deut. Chem.*, v., 796. *Bull. de la Soc. Chim*, 18, 2, xviii, 549.
¶ Wurtz, Matières Colorantes.

point at 287° C. (Hofmann; at 276° to 277°, uncorrected, Zincke). It is only very slightly soluble in water, better in alcohol and ether. According to A. W. Hofmann it is not advisable to take $(NH_4)_2S$, as that salt decomposes the phenylen-diamine, partially forming a brown mass.

(To be continued).

PRELIMINARY NOTICE OF A NEW YELLOW COLOURING MATTER.

By RAPHAEL MELDOLA.

Diphenylamine is dissolved in from six to seven times its weight of glacial acetic acid, and a stream of nitrogen trioxide passed through the cooled solution for some hours. A yellow crystalline substance separates out, which is filtered off, and washed with cold water till free from acid. This substance, when boiled with an alcoholic solution of sodic hydrate, is decomposed with the formation of a deep red solution, and on pouring into water, a substance of a fine yellow colour separates out in minute crystals. The new colouring matter thus obtained is insoluble in water, soluble in benzene, petroleum, and alcohol. It dyes silk and wool of a most brilliant yellow colour, and is unaffected by either acids or alkalies. A scientific examination into the nature of the compounds produced in these reactions is now in progress.

Atlas Works, Hackney Wick, London, E.,
January 31, 1878.

ON THE MANUFACTURE OF IODINE, BROMINE, AND NITRATE OF POTASH TOGETHER WITH SODA BY THE AMMONIA PROCESS.

By THORWALD SCHMIDT, Aalborg, Denmark.

There has of late been addressed to me from various places inquiries and requests for particular information, as to the method of the combined manufacture of the above products, probably because Mr. E. C. C. Stanford, Glasgow, in the Chemical News, April, 1877, in his treatise on the manufacture of iodine, touches on this combined process. I therefore willingly give an explicit representation of the details.

The ashes of the seaweed—kelp—are washed according to the method given by Shanks, St. Helens, near Liverpool, for which purpose is used a series of large square vessels, over whose real bottom is applied another double bottom furnished with holes. From the space between the real bottom and the one with holes a pipe leads into the upper part of the next vessel; from the bottom of the latter a pipe like the former leads into the next, and so on. In this manner the fresh water always meets the most washed ashes, and the fresh ashes the strongest solution. The exhausted ashes may be used as excellent manure, or may still more profitably be sold in places where the phosphoric acid therein contained may in any other manner be of use.

The solution having been concentrated as much as possible, is to be tapped into a reservoir large enough to hold the quantity of liquor containing chloride of calcium sufficient to transform the sulphates contained in the solution into hydrated sulphate of lime and chloride combinations.

The liquor of chloride of calcium is to be had in large quantities as a refuse from the manufacture of ammonia-soda. At first we must ascertain how much chloride of calcium is requisite, and then it is added gradually under continual stirring, until no more sulphate of lime precipitates; but of course no more chloride of calcium must be added than is strictly needful.

When the liquor, after a careful mixing, is left to itself, the greatest part of the sulphate of lime will soon deposit on the bottom of the vessel, but a part of it finely divided will still continue to float in the liquor whilst another part of it dissolves in it.

A small distance above the bottom of the vesse is attached a pipe in connection with a suction and forcing pump; when the liquor has become tolerably clear, the pump is worked, and the fluid is forced through a filter-press into a similar reservoir. The fluid is now quite clear, and of the sulphuric salts only the dissolved sulphate of lime remains.

Now we take a sample of the solution, test how much of the chloride of barium is needed to precipitate the sulphuric acid in the dissolved sulphate of lime, as sulphate of baryta, weigh the necessary quantity of chloride of barium, and dissolve it in as much of the solution as needful. The latter solution is poured into the vessel, and the liquid is well stirred, that the mixture may be as complete as possible.

Another pump, likewise with a pipe in connection with this reservoir, again presses the liquid through a second filter-press into the third reservoir.

When a large quantity of sediment of sulphate of lime is gathered in the first reservoir, the latter is cleared, and this sulphate of lime, as well as that from the filter-cloths, is to be well washed, and the washing is used again for dissolving the kelp.

We have of course now—

Precipitated sulphate of lime=*Annaline*, or pearl-hardening;

Precipitated sulphate of barytes=*Blanc fix*, or permanent white; and all the sulphates in the fluid transformed into chlorides.

We now examine how much of iodine and bromine is contained in this clear liquid, and put so much nitrate of lead to it that we are sure of a small surplus, so that a little chloride of lead may be precipitated. The liquid is to be stirred well, that a careful and intimate mixture may take place, and this stirring is to be continued until the lead solution is all poured in.

As soon as we are sure of a complete mixture, the pump which is in connection with this vessel is worked, and the liquid is, as in the foregoing operation, forced through a third filter-press into a fourth reservoir. We have then, when the vessel is employed, all the iodine and bromine with a little portion of chloride, as iodide, bromide, and chloride of lead on the filter-cloth. In this manner all loss of iodine and bromine is prevented, which in the manner generally adopted can only be attained through careful and repeated washings, and a considerable quantity of fuel and time is saved. The iodide and bromide of lead is then worked into such combinations as are required.

The liquor from this operation contains, as may be understood, besides the trifling quantity of nitrate from the nitrate of lead, all the potash, soda, magnesia, and lime combinations as chlorides. To this is put some dirty carbonate of soda, such as sweepings from the soda works, to precipitate the magnesia and the lime. Having stirred the liquid in the vessel for some time, we again let the liquor, by means of a pump, pass a filter-press, and in this liquor we dissolve as much nitrate of silver as is needful to transform the remaining potash into nitrate of potash, after which it is treated in the manner generally used in manufacturing of nitrate of potash. Still, it is advisable to apply the filter-press before the beginning of the evaporation.

The salts left as a refuse by this mode of manufacture are excellent materials for the manufacture of soda by the ammonia process, which has been proved long ago by practice, and it is, therefore, after the experience I have had, my firm conviction that these industries are in a high degree adapted to be combined. Either we wish to carry

on the whole combined business, or only the manufacture of soda and nitrate of potash, so much the more as we may work proportionately as profitable in a small as in a large manufactory of soda, of course within certain limits. We are of opinion that such a manufactory must not produce less than 20 or 30 cwts. of soda per day, and the furnishing will, besides the cost of buildings and boilers, amount to about £1600.

In beginning such an enterprise on a smaller scale we have the advantage with proportional small means, to be able to surmount the technical difficulties, exercise the workmen, arrange the circumstances connected with the sale, and are always able to extend the works.

Where seaweed is to be had in large quantities on the coast, or where there is already a manufactory of nitrate of potash, or where rocksalt or salt wells are near, and coals and limestone may be had tolerably cheap, there a manufactory of ammonia-soda will be carried on with profit.

For further explanation I shall only add that 180 to 200 parts of salt, 105 parts of good coal, 5 parts of sulphate of ammonia, 23 parts of coke, 1 part of sulphuric acid, and 80 parts of limestone are the raw materials for 100 parts of refined soda, 95-97 per cent. equal to about 270 parts of crystal soda. I shall willingly—if such is wanted—give the details of such an establishment.

The manufacturing itself of ammonia-soda is, with appropriate apparatus, by no means more difficult than any other mere chemical manufacturing business; and it has this good point, that no persons will easily understand what takes place, unless they are intimately connected with it, or the operation of the apparatus is explained to them, nor can the workmen give any particular information; it is thus possible, with a little care, to keep this interesting manufacture a secret to the public for a long time.

PROCEEDINGS OF SOCIETIES.

INSTITUTE OF CHEMISTRY OF GREAT BRITAIN AND IRELAND.

The first General Meeting of this Institute was held on the 1st inst. at the Rooms of the Chemical Society, Burlington House. Dr. Frankland, F.R.S., President, in the chair.

In an able address the President reviewed the development of practical and professional chemistry in this country, the present status of trained and educated chemists, and the sequence of events and considerations which led to the formation and incorporation of the Institute. At the beginning of the year 1845 he (the President) could only hear of one laboratory in which to obtain instruction in chemical analysis. This laboratory was in the cellar of the Royal Institution in Manchester, and was under the direction of Dr. Lyon Playfair. About the same time the Royal College of Chemistry was opened by Dr. Hofmann. From it, and from one or two other laboratories subsequently established, there soon issued a veritable army of chemists who instituted practical instruction through the length and breadth of the land. Henceforth the opportunities of becoming practically acquainted with chemistry were greatly multiplied. It became an independent subject of instruction in Schools, Colleges, and Universities, and thus, in connection with the Science and Art Department alone, there were in the year 1876 no less than 115 chemical laboratories, in which 2400 pupils received individual practical instruction.

This rapid advance Dr. Frankland ascribed partly to the fascination of a study which brings the pupil continually into the closest contact with nature, and partly to the great increase in the number and importance of the applications of chemistry to agriculture, technology, public health, and the daily wants of modern civilisation. These intimate relations of applied chemistry to daily life have rendered necessary an organisation amongst chemists which should stand in the same relation to the profession of chemistry as that occupied by the Colleges of Surgeons and Physicians towards medicine, the Institute of Civil Engineers towards the profession of civil engineering, and the Inns of Court towards the practice of law. On the occasion of the Dinner in honour of Professor Canizzaro's visit to England as Faraday Lecturer in May, 1872, he (the President) had suggested such an organisation, but no attempt was made to originate such a scheme until April, 1876, when it was sought to accomplish the necessary objects in connection with the Chemical Society. Legal and other difficulties, however, prevented the carrying out of this scheme, and it was resolved to form an association independent of the Chemical Society.

The necessary memorandum and articles of association were then drawn up, and application for incorporation was made to the Board of Trade as "The Institute of Professional Chemists." From a correspondence which ensued with the Board of Trade the promoters of the Institute learned to their astonishment that in the eye of the law they were not chemists at all, either professional or otherwise.

It appears that on receiving the application for incorporation the Board of Trade communicated with the Privy Council, and the Privy Council asked the advice of the Pharmaceutical Society. The Council of this Society urged as an objection to the new scheme the fact that they had appointed a Board of Examiners, and that those who passed the major examination of the Society were registered as Pharmaceutical chemists, while those who passed the minor examination were registered as Chemists and Druggists. The Council therefore contended that a sufficient guarantee was already afforded to the public or the courts of law of the competency of persons called as experts in chemical science, and that simple means already existed by which persons having recourse to chemists can prove their training and fitness for the skilful performance of the work they undertake. The Council also objected to the term "Professional Chemists," urging that all persons who have studied and may practise the science of chemistry, whether as applied to pharmacy, agriculture, or any other special object, may claim to be professional chemists. The Board of Trade therefore wrote to the promoters of the Institute, requiring them to modify their scheme so as to meet the objections of the Pharmaceutical Society. The promoters accordingly changed "Professional Chemists" to "Chemistry" in the title of the proposed Institute, and resolved to insert the following words in the Memorandum of Association:—"That no Fellow or Associate be entitled to a certificate of his Fellowship or Associateship." The opposition of the Pharmaceutical Society was then formally withdrawn, but the Board of Trade afterwards requested that the following sub-section, describing one of the objects of association, should be struck out:—"To ensure that consulting chemists and analytical chemists are qualified by study and training for the proper discharge of the duties they undertake." On being asked to state the grounds upon which the omission of the paragraph was asked for, the following letter was sent by the Solicitor to the Board of Trade to Mr. Pettengill:—

"Board of Trade,
"(Railway Department),
"London, S.W., 2nd July, 1877.

"Sir,—With reference to your interview with me this afternoon relative to the omission of sub-section 6 of section 3 of the Draft Memorandum of Association of the proposed Institute of Chemistry, I am directed by the Board of Trade to inform you that in accordance with your wish I have communicated with counsel on the subject. I am now to inform you that the sub-section was struck out on two grounds:—

(1.) Because it appeared to point to the granting of certificates and to nothing else.

(2.) Because it appeared to cast a doubt on the fitness of the Pharmaceutical Society to perform their duties, inasmuch as it is the duty of the Pharmaceutical Society to see that consulting chemists are duly qualified, and the fitness of the Society to perform that duty has been recognised by the State, and this being so further *security* for the qualifications of chemists does not appear to be needed.

As regards the fear which you expressed that the omission of the sub-section might be fatal to the promotion of the Institute, I am to add that it appears to this Department to be at least doubtful whether the words "to ensure that consulting chemists and analytical chemists are duly qualified" are required for anything (other than the grant of certificates) which the promoters can not do under the remaining part of the Memorandum.—I am, Sir,

"Your obedient servant,

"Henry E. Calcraft.

"J. Pettengill, Esq.,
"32, Walbrook, E.C."

It was, remarked the President in his address, of no avail to explain to the Board of Trade that membership of the Institute of Chemistry would confer no right to keep a druggist's shop, or to interfere with trade in any way, and that the titles "Chemist and Druggist" and "Pharmaceutical Chemist" have always been exclusively applied to persons keeping shops for the sale of drugs; whereas the terms "Chemist," "Analytical Chemist," and "Professional Chemist" have always been applied to persons specially trained in the science of chemistry. In adhering to their views on this matter the officials of the Board of Trade no doubt took their stand upon an act of Parliament which declares that a chemist, however eminent in his profession, shall not, under a penalty of £5 for each offence, describe himself as such unless he be duly registered as a chemist and druggist or a pharmaceutical chemist. The President of the Chemical Society, for instance, could not, in a court of justice or elsewhere, use the designation by which he is known all over the civilised world without thus infringing the laws of his own country.

While through the instrumentality of its excellent laboratory and its prescribed course of general education the Pharmaceutical Society has greatly raised the status of the druggist, and has conferred dignity upon a most important occupation, which, before the incorporation of the Society, was too often carried on by grocers, oilmen, and others entirely ignorant of the properties of drugs, Dr. Frankland thought the Society overstepped the limits of strict justice when, in 1868, it laid exclusive claim to a title which is the common property of all who cultivate the science of chemistry.

After receiving the above letter the promotion of the Institute had to choose either the acceptance of the condition of registration imposed by the Board of Trade or the establishment of the Institute as a private society. They decided upon the former alternative, and agreed to the removal of the sub-section, provided the next following sub-section were made to read as follows:—

"To adopt such measures as may be necessary for the advancement of the profession of chemistry, and particularly for the maintenance of the profession of the consulting and analytical chemist on a sound and satisfactory basis."

According to these amended statements of the Institute which were accepted by the Board of Trade still enable the Council to appoint and remunerate examiners, and to insist upon a high standard of qualification for admission to Associateship and Fellowship, such, for instance, as a sufficient preliminary general education and special training, the passing of satisfactory examinations in general chemistry, in the practical qualitative and quantitative analysis of minerals, organic compounds, and gases, in physics, and in mathematics, and a subsequent three years course of study and practical work in applied chemistry.

The President pointed out that these qualifications would serve to distinguish Fellowship of the Institute from Fellowship or Membership of any other body whatever in this country. The taking a medical degree requires only a very limited knowledge of theoretical chemistry, affords no testimony to the competency of the possessor to perform more than the very simplest operations of practical chemistry, and constitutes no guarantee that even an examinee in honours possesses that knowledge which is absolutely necessary for the efficient practice of professional chemistry; and the major examination of the Pharmaceutical Society, so far from justifying the opinion of the Solicitor to the Board of Trade, that "further security for the qualification of chemists does not appear to be needed," involves only the merest elementary knowledge of physics and arithmetic, aud prescribes only the following practical knowledge of chemistry:—"The nature and properties of the elements and their compounds, both organic and inorganic, especially those used in Medicine or the Arts. Also the *qualitative* analysis of the more important chemicals—such as nitrates, chlorides, carbonates, sulphates, phosphates, oxalates, tartrates, &c.—and the detection of impurities in them, and the *volumetric* estimation of the *strength* of all Pharmacopœia preparations in which standard solutions are ordered to be used." So that this examination, which even stops short of every species of gravimetric quantitative analysis, tests only the simplest elements of that thorough knowledge which the Institute proposes to require of its candidates. Excellent as it is for testing the qualifications of a pharmaceutist, such an examination affords no test of the qualifications of those professional chemists who undertake the duties of Public Analysts,—or of giving advice in the applications of Chemistry to the Arts, Agriculture, and Public Health,—or of investigations in connection with the applications of Chemistry to Technical Industry. The President concluded his Address by paying a high tribute of praise to Mr. W. N. Hartley for the efficient manner in which he discharged the exceptionally heavy duties which fell upon him as an Honorary Secretary of the Institute up to the date of incorporation.

Dr. Odling, in proposing that the thanks of the Meeting be given to the President for his Address and that it be printed and circulated, took exception to that paragraph in the Address which spoke of Dr. Lyon Playfair's Laboratory as the first Laboratory of Practical Chemistry in England. A discussion ensued, during which it was mentioned that the late Dr. Graham's Laboratory was opened for practical teaching in 1840.

Dr. Attfield seconded the vote of thanks to the President, and referred to the establishment of, and the instruction given in, the Pharmaceutical Society's laboratory.

Mr. Riley and Dr. Tidy asked for information respecting the difference between a "Member" and a "Fellow" of the Institute.

Mr. Pettengill (the Solicitor) explained that the Fellowship had been introduced to meet the wishes of the promoters with regard to chemists residing abroad, and who were prevented from taking part in the affairs of the Association, but according to the Act under which the Institute was incorporated only "Members" were recognised.

A long discussion ensued, and it was ultimately decided that the Council should amend the articles so as more effectually to explain the meaning of the terms "Member" and "Fellow."

The Secretary read the following report:—

Report of Council.

The most important business which your Council has transacted since the incorporation of the Institute has necessarily been the development of the organisation by providing as far as posiible for the admission of all compe-

tent chemists into the Association. In order to form a nucleus for the Institute it was deemed advisable in the first place to invite all those chemists of standing in the profession who were well known to members of Council, either personally or by repute, and with this object your Council at their first meeting—after formally electing as Fellows those members of the Organisation Committee who were not on the Council—instructed the Secretary to issue invitations to the most prominent members of the profession whose names had been selected by a committee appointed for that purpose, asking them to join the Institute. It is very likely, however, that the names of some few gentlemen were accidentally omitted from the list, although the Council has endeavoured to make it as complete as possible. A committee was then appointed to examine into the qualifications of candidates for admission to the Institute, not only of those who made personal application through the Secretary, but also of those who were proposed by Members of Council. At the same time advertisements were inserted in the *Times*, CHEMICAL NEWS, and *Nature*, announcing that the time for admission of original Fellows and Associates would expire on the 2nd of February, 1878. A large number of applications (over 150) were made asking for information as to the means of obtaining admission to the Institute, and of these 93 have already become candidates for the Fellowship or Associateship, and sent in formal applications accompanied by certificates. The Nominations Committee has carefully considered the qualifications of the several candidates, requiring as a rule that they should be those expressed in articles 56 and 60, namely, for Fellows—(1.) That he is not less than twenty-four years of age. (2.) That he has passed through a course of three years' training to the satisfaction of the Council in theoretical and analytical chemistry and physics, and has subsequently been engaged for three years either as assistant to a chemist of repute, or as a Professor or Demonstrator of Practical Chemistry at some known University, College, or Medical School, or as a chemist in a technical industry, or has, after three years' training as above, conducted and published an original research of sufficient merit, in the opinion of the Council, on some chemical subject necesitating practical work. Or, (3.) That he has been trained and occupied in other ways, which in the opinion of the Council are equivalent to fulfilling the conditions stated in the preceding article. For Associates—(1.) That he is not less than 21 years of age. (2.) That he has passed through a course of three years' study of theoretical and analytical chemistry, physics, and elementary mathematics satisfactorily to the Council. In very few instances only has the Council found it necessary to depart from this rule. Where candidates were not actually proposed by Members of Council they were required to produce certificates or other documentary evidence that their statements as to their training and subsequent chemical career were substantially correct. In the case of Associates, such was the satisfactory character of their training and experience that many of them might advance a valid claim to be admitted as Fellows if they were not disqualified by being under the age of twenty-four. All of them possess the qualifications specified in article 60—2, of having passed through a course of three years' study of theoretical and analytical chemistry, physics, and elementary mathematics. The objects of the Institute have been favourably regarded by almost all who have been invited to join, and even those who, from one cause or other, felt unable to take up the Fellowship have, with one or two exceptions, expressed sympathy with the objects of the Institute and wished it every success. Of the chemists invited to join at the first Council meeting 153 have already accepted the Fellowship. Since the first Council meeting 160 more Fellows and 43 Associates—proposed by Members of Council, or who have made personal application—have been elected, and of these 65 have accepted. As, however, only a short time has elapsed since the election of the greater number of these gentlemen no accurate estimate can be made of how many will eventually join, although, considering that nearly all have applied for admission to the Institute, either directly or through some Member of Council, in all probability there are but few of them who will not become either Fellows or Associates. At present, 225 Fellows have joined the Institute, and 87 have been elected, but yet not formally admitted. Your Council is of opinion that a high standard of education and training should be fixed as a necessary qualification for admission to the Associateship, not only in theoretical and practical chemistry, but also in the subsidiary subjects of physics and elementary mathematics, and that such a standard can only be maintained by a carefully arranged system of examinations. A committee has therefore been appointed for the purpose of drawing up a complete examination scheme, who will in a short time report to the Council on the best methods of obtaining these objects. The Council intend to publish, as early as possible, a complete list of the Fellows and Associates of the Institute. It is with the greatest pleasure that your Council announces that Dr. Frankland has offered two prizes of £50, each to be awarded by the Council of the Institute, and announced at the next General Annual Meeting, for the two best original investigations involving gas analysis, and conducted by Associates of the Institute. In conclusion, the Council desire to express their thanks to the President and Council of the Chemical Society for the use of their rooms on this and many previous occasions.

Mr. THORP proposed and Mr. RILEY seconded that the report be adopted.

The TREASURER then presented a Balance Sheet made up to December 31, 1877.

The meeting proceeded to elect by ballot four Censors. The Scrutators (Mr. Spiller and Mr. Newlands) announced that Dr. Warren de la Rue, F.R.S., Prof. Abel, F.R.S., Dr. Odling, F.R.S, and Dr. Roscoe, F.R.S., were duly elected.

The proceedings then terminated.

ROYAL INSTITUTION OF GREAT BRITAIN.

General Monthly Meeting, February 4, 1878.

WARREN DE LA RUE, D.C.L., F.R.S., Vice-President in the Chair.

THE special thanks of the Members were given to Mr. William Bowman, F.R.S., M.R.I., for his present of an ivory bust of Professor Faraday, by the late Matthew Noble, M.R.I.

In reference to the Telephone, which Mr. Preece had explained to the Members on Friday last, the CHAIRMAN stated that he had made attempts to measure the current produced by the vibrations of the disk of iron in front of the magnet of the telephone, and that he was unable to detect any by means of a most sensitive dynamometer which would render evident the current of a Daniell's cell through 2000 ohms. Moreover, by other experiments made by other means, he concluded that the current produced did not amount to that which a Daniell's cell would send working through 100 millions ohm resistance.

PHYSICAL SOCIETY.

Annual General Meeting, February 2, 1878.

Professor G. C. FOSTER, F.R.S., President, in the Chair.

THE PRESIDENT read the Report of the Council for the past year. After pointing with satisfaction to the present condition of the Society, the Report goes on to show how it is hoped to extend its usefulness in the future. In addition to a second edition of Prof. Everett's work on the "C.G.S. System of units," the Council hopes very shortly

to publish Sir Charles Wheatstone's papers in a collected form, and it is making arrangements for the publication, at intervals, of translations of foreign scientific papers, especially such as have had a marked effect on the progress of physical science. A portion of the funds of the Society is to be devoted annually to the formation of a library, and an exchange of publications is already made with various learned societies abroad. Special stress was laid on the distinctive object held in view at the formation of the Society, namely the exhibition, when practicable, of the experiments referred to in papers read at the meetings.

The following Officers and Council were elected for the ensuing year:—

President—Prof. W. G. Adams, M.A., F.R.S.

Vice-Presidents (who have filled the office of President)—Dr. J. H. Gladstone, F.R.S., and Prof. G. C. Foster, F.R.S.

Vice-Presidents—Prof. R. B. Clifton, M.A., F.R.S.; W. Spottiswoode, LL.D., F.R.S.; W. H. Stone, M.B., F.R.C.P.; Sir W. Thomson, LL.D., F.R.S.

Secretaries—A. W. Reinold, M.A.; W. Chandler Roberts, F.R.S.

Treasurer—Dr. E. Atkinson.

Demonstrator—Prof. F. Guthrie, Ph.D., F.R.S.

Other Members of the Council—Capt. W. de W. Abney, R.E., F.R.S.; Prof. W. F. Barrett, F.R.S.E.; Major E. R. Festing, R.E.; W. Huggins, D.C.L., F.R.S.; Prof. A. B. W. Kennedy, C.E.; O. J. Lodge, D.Sc.; Prof. H. M. McLeod; The Earl of Rosse, D.C.L., F.R.S.; Prof. W. C. Unwin, B.Sc.; R. Wormell, D.Sc.

Prof. H. L. F. Helmholtz and Prof. W. E. Weber were elected Honorary Members of the Society.

After votes of thanks had been passed to the Lords of the Committee of Council on Education for the use of the Physical Lecture Room at South Kensington, as well as for the other advantages enjoyed by the Society, and to the several Officers of the Society, the meeting was resolved into an ordinary one.

The following candidates were elected members of the Society:—M. T. Cormack; C. J. Faulkner, M.A.; E. M. Jones, F.R.AS.; C. Leudesdorf, M.A.; and C. E. Walduck.

Prof. S. P. Thompson exhibited an experiment in illustration of Ampère's law of parallel votaic currents. A plate of glass is perforated by two holes close together, which are traversed by one and the same wire, and this may be so arranged that the current traverses the parallel lengths in the same or opposite directions. If now the plate be held horizontally while the current passes, and fine iron filings be sprinkled on the plate, they will arrange themselves in the well-known forms. In the plates exhibited the filings had been fixed by gum so that their arrangement could be exhibited to an audience by projection on a screen.

EDINBURGH UNIVERSITY CHEMICAL SOCIETY.

Fourth Meeting, January 30, 1878.

Mr. Newton Burns in the Chair.

Papers were read by Mr. G. Carr Robinson, F.R.S.E., on the "Solid Fatty Acids in Cocoa-nut Oil;" and by Mr. Thomson, "On the Composition of the Gases from Lime-kilns."

NOTICES OF BOOKS.

The Retrospect of Medicine. Edited by W. Braithwaite, M.D., and James Braithwaite, M.D. Vol. lxxvi., July to December, 1877. London: Simpkin and Marshall.

This volume, as usual, contains a useful summary of the progress of medical science during the past half year, though there is little to interest the scientific chemist.

We are particularly struck with the sanitary, or rather unsanitary, condition of China, where filth of all kinds reeks over land and water, and yet the consequences we should naturally expect do not follow. "There is no typhus, no typhoid or other disease considered the inevitable consequence of defective sanitation, although Amoy and indeed all Chinese towns are full of typical fever-dens. No case has been met with, in either Amoy or Formosa, of scarlet fever, measles, relapsing fever, or diphtheria." Ague, cholera, and small-pox, however, abound. There are depths in the philosophy of zymotic disease to which we have not yet penetrated. The Chinese, it is remarked, never drink water which has not been previously boiled, and have no drains carried under their houses.

Eighth Annual Report of the State Board of Health of Massachusetts. January, 1877. Boston: A. J. Wright.

This volume comprises a number of essays and reports, of greater or less value, dealing with sanitary questions. The paper on the "Pollution of Streams" is characterised by a strong tendency to view facts through irrigationist spectacles. The Lawson case, where the "germs" of typhoid fever were found to pass through nearly a mile of gravel, if it proves anything at all, shows that the effluents from irrigation farms are not necessarily freed from any infectious matter which may have found its way into the sewage.

The reports on the "Registration of Disease," on the "Growth of Children," and on "Disease of the Mind," are of much higher value. In the last of these three essays the writer seems to doubt the influence commonly ascribed to heredity—a very satisfactory doctrine if thoroughly borne out by facts. He concludes with the following passage:—"Even as late as the time of the Ptolemies the plague was unknown in Egypt. One hundred years ago it was thought a necessary part of modern civilisation, and now, under a still higher civilisation, the area over which it is to be feared is narrowing from year to year. A similar result may be fairly expected with regard to diseases of the mind."

Unfortunately, except we are grievously misinformed, the plague is of late years extending its ravages, and the possibility of its re-appearance in Europe is now contemplated not without anxiety. Till modern civilisation can be freed from the anxiety and "worry" which are its greatest blots, we can scarcely expect a decrease in mental disease. The movement in England is at present in the opposite direction.

Medizinische Jahrbücher heraus gegeben von der K. K. Gesellschaft der Aerzte. Jahrgang 1877, Heft iv. Vienna: Braumüller.

The most interesting paper in this journal is an account of a fatal case of chronic arsenical poisoning from the use of magenta in the arts. The patient, a maker of garlands for graves, had been accustomed to colour artificial flowers, moss, &c., with magenta and iodine green. After death arsenic was detected in all the solids and liquids of the body, except the bones and the urine. Samples of magenta, obtained from various colour merchants in the city, were submitted to quantitative analysis, the result being that one alone was free from arsenic, the poison in the others ranging from 0·23 to the serious proportion of 2·7 per cent. The writers attach great importance to this case, as proving that fatal doses of arsenic may be absorbed through the skin, in the ordinary technical uses of magenta, without the ingestion of the poisonous colour.

CORRESPONDENCE.

FEES.

To the Editor of the Chemical News.

Sir,—In a trade journal the proprietors have instituted a new department called "Our Laboratory," which is said to be placed in charge of a highly-qualified analytical chemist. "The purpose is to render the chemical analysis of all products in which the readers are interested more popular and more generally useful than at present." This is to be brought about by "having samples analysed and publishing the results, together with such information, comment, or description as will tend to render the information afforded by the analysis available to all who are interested in the subject. Should samples be forwarded by any of our subscribers, the analysis shall be performed for *about half the usual rates*, we reserving the right to publish when we think fit the results. Sellers of articles can have their goods analysed and the results published for the usual analytical fee and by arrangement with the editor, *through whom* the customer will receive an ordinary certificate of analysis, and who will receive fees, and answer all inquiries." Mr. Editor, I have no fault to find with the proprietors of the journal for wishing to popularise and make analytical chemistry more useful; but I do object to them setting up as analytical chemists, and I also object to the highly-qualified analytical chemist doing the work for *less* than half the usual fees. What I would ask is—where has the reduction of fees to stop? A client of mine wrote for a quotation for an analysis. I quoted the usual fee. He wrote me to say that a well-known firm of wholesale chemists and druggists allowed him a discount of 25 p.c. from the usual fees. I find it is becoming a common practice. The usual fee will become so small shortly that it will be a difficult matter to allow 25 per cent. I think the above is one of the grievances of chemists who live by analytical work; and in my opinion the Institute of Chemistry will serve a very useful purpose if it unites chemists, and excludes, not only the incompetent, but the competent, who are ruining the profession by accepting very low fees.—I am, &c.,

George Whewell, F.C.S.

Exchange Chambers, Blackburn.

ASSIMILATION OF NITROGEN BY PLANTS.

To the Editor of the Chemical News.

Sir,—I fell gratified that you have considered Johnston and Cameron's "Agricultural Chemistry and Geology" a work sufficiently important to warrant the long notice of it which appears in your issue of Jan. 11. In referring to that notice I merely desire to explain that I have not omitted referring to Berthelot's investigations (see page 238), but these investigations merely show, not that plants absorb free nitrogen, but that nitrogen is, under the influence of the "electric effluve," converted into compounds assimilable by plants.—I am, &c.,

Charles A. Cameron.

Dublin.

ON THE LUMINOSITY OF BENZOL, &c.

To the Editor of the Chemical News.

Sir,—With your permission I should wish to offer a few remarks on the paper "On the Luminosity of Benzol, &c.," which you report to have been read by Messrs. Frankland and Thorne at the last meeting of the Chemical Society.

Dr. Frankland claims credit for having "pointed out in 1852 that hydrogen, carbonic oxide, and marsh gas practically contribute nothing to the luminosity of coal gas, and that the only constituents of value were *benzol*, ethylene, propylene, butylene, and *acetylene*." (The italics are mine.)

I always thought that the non-luminosity of the flames of hydrogen and carbonic oxide had been known to every chemical schoolboy, and that the feeble luminosity of a fish-tail flame fed by *pure* CH_4 known at least to every *chemist*.

To pass to the positive part of Dr. Frankland's alleged discoveries in 1852, it is rather remarkable that he should then have insisted upon the importance of *acetylene* as a luminiferous agent. It is true the gas had been discovered many years before by E. Davy, but chemists had entirely lost sight of it, and it has always been my impression that it was *Berthelot* who re-discovered it, in 1859.

Now, as to the benzol, what I have to say is that in 1857, when I worked in Bunsen's laboratory, the existence of benzol in coal gas was there simply ignored; all the part absorbable by fuming vitriol was put down as so much "*ethylene*" plus so much "*ditetryl*." Now, in 1852, Dr. Frankland came fresh from Bunsen. *Bunsen's* knowledge of the subject could not have *de*creased between 1851 and 1857, and we have no evidence of Dr. Frankland at the time having added anything to what he had learned from his master.

I have not Dr. Frankland's original paper at my disposal, but from the abstract given in the *Jahresbericht* it appears that in his analysis he simply reported his sum-total of the carbon "vapours" present in the part absorbable by fuming vitriol, and assumed the percentage of such carbon vapours to approximately measure the luminosity of the gas.

Dr. Frankland, at the time, of course, looked upon that carbon as having been present in the gas (substantially) in the form of *olefines*. If he had thought that any noteworthy portion of it consisted of benzol, and that this benzol had any considerable share in the luminiferous power of this gas, he would have said so; but he does not. *Nobody*, in fact, dreamed of the paramount importance of benzol as a light-giver in coal gas until a little over a year ago it was *asserted* by *Berthelot* (as a sequence from an *erroneous* assumption), and *proved* by me in a paper "On the Proximate Composition of Coal Gas," which I communicated to the British Association, in Glasgow, in 1876, and subsequently published in your columns. In that paper I show that Berthelot's notion that ethylene could not publicly be present in more than traces in a pyrogenic gas is contrary to direct evidence; but I also prove that while hydrogen gas, impregnated with benzol to the extent of 3 per cent (by vol. of C_6H_6 vapour) gives a brilliantly luminous fish-tail flame, a mixture of C_2H_4 and hydrogen containing the same percentage of carbon vapour yields a flame like that of a Bunsen's burner.

In the introduction to my paper I distinctly stated that I was engaged in attempting, *by synthetical experiments, to determine the extent to which the several constituents of coal gas contribute to its luminosity*. A copy of my paper was forwarded to Dr. Frankland.

After the above I leave it to you and your readers, Mr. Editor, to form your own estimate of the merits of Dr. Frankland's latest scientific publication.—I am, &c.,

W. Dittmar.

Andersonian College, Glasgow, January 30, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 27, December 31, 1877.

Constitution and Structure of the Meteoric Iron of Santa Caterina (Brazil); Conclusions drawn from its Characters respecting the History of the Me-

teoric Rocks, and especially the Habitual Association of Carbon with Iron Sulphide.—M. Daubrée.—The structure of polished sections of the specimens received by the author shows a decidedly breciaform character. The mass of iron has been reduced into a multitude of angular fragments, which have then been cemented together by a network of irregular little veins. These veins contrast in their yellow-bronze colour with the reddish grey tone of the nickeliferous iron. The substance which forms the chief mass dissolves in acids with evolution of hydrogen sulphide and deposition of sulphur, and is therefore a ferric sesqui-sulphide or pyrrhotine. The residue is coloured strongly black by graphite. Where the veins of pyrrhotine touch the iron they sometimes present a slender but brilliant margin, which has the characters of a phosphide. Other veins, much more slender than those of pyrrhotine, traverse at once the metallic iron and the veins of pyrrhotine, and are formed of magnetic oxide of iron, partly crystalline. In meteorites the sulphide of iron is mixed with carbon, as if the combination resulted from the action of carbon bisulphide upon iron. Possibly, also, the association of carbon with iron phosphide may result from the action of phosphorus sulphide upon metallic iron.

Condensation of Gases hitherto supposed Permanent.—M. Berthelot declared that he had witnessed M. Cailletet's experiments upon nitrogen and hydrogen. The liquefaction of hydrogen did not appear to leave any room for doubt, according to the succession of phenomena. The observations made with hydrogen have also furnished indications, not doubtful, in M. Berthelot's opinion, of the liquefaction of the gas, though less complete and more difficult to apprehend than in the case of nitrogen. From their aspect and their brief duration they represent the degree of attenuation of the liquid dust which is produced towards the end of the phenomena recognised in the case of nitrogen,—that is to say, in the period immediately preceding the disappearance of the mist. The extreme tenuity of the liquefied particles which constitute this mist of hydrogen, as well as their more rapid return to the gaseous state, agree perfectly with the properties of hydrogen as compared with other gases. What gives the experiments of M. Cailletet their character and their peculiar certitude is that they show, and enable us to compare—in one and the same transparent and limited space—the gas in three successive states; as a compressed elastic fluid, a pulverised liquid, and a liquid in great part released from pressure.

Cause of the Spontaneous Alteration of Eggs: a Reply to M. U. Gayon.—MM. A. Béchamp and G. Eustache.—The authors maintain the two following propositions:—The vitelline membrane is impenetrable to every organism coming from without. The production of Infusoria within the yolk of the egg is due not to germs coming from without, but, when it does take place, to the evolution of the normal microzymas (elementary granulations) of the yolk, which are transformed first into connected and articulated microzymas, and subsequently into bacteria.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 17, December 27, 1877.

The Abbé Laborde proposes a "writing telephone." It will suffice, he says, to separate the recipient, and to fix to one of the conducting wires a metallic plate, and to the other an iron point slightly rounded at its extremity. Between this plate and the point intended to complete the circuit must be placed a long band of paper, prepared as for Bain's electro-chemical telegraph, to which a regular movement must be imparted in the direction of its length whilst the telephone is in action. At each double vibration the iron point will make a black mark upon the paper: for if the metallic membrane determines a negative current as it approaches the fixed magnet it will produce a positive current on departing from it, and it is in this second current which, as it issues from the point, will mark its passage upon the paper.

Reagent for Alcohol.—M. Jacquemart.—The reagent is a solution of nitrate of mercury obtained by treating the metal with a suitable proportion of nitric acid of mean strength. The action of this acid nitrate upon ethylic alcohol is rapid. If a little ammonia is added to the mixture after the reaction a black precipitate is obtained, the more intense the greater the proportion of alcohol present. Methylic alcohol and other analogous liquids behave quite differently, and do not give a black precipitate with ammonia.

No. 1, January 3, 1878.

M. Milne-Edwards has been nominated President of the Scientific Association of France.

No. 2, January 10, 1878.

This issue contains no original chemical matter.

No. 3, January 17, 1878.

This issue contains no original chemical matter.

No. 4, January 24, 1878.

The electric light is to be utilised on a very large scale in connection with the approaching Exhibition at Paris.

A reward of 3000 francs is offered by the German Society for the Encouragement of Industry for an easy and accurate method of detecting the presence of glycerin in beer.

Rodent and marsupial animals enjoy a perfect immunity from the poisonous effects of *Belladonna* and the other Solanaceæ, and, according to the experiments of M. Battandier, mice may be fed for a week upon the seed of hemlock without injury.

M. H. Kaemmerer recommends tannin as a valuable agent in the analysis of potable waters. Wells in the vicinity of cemeteries, or which are contaminated with manufacturing refuse, may contain gelatin. The reagent and the water should be left in contact for twenty-four hours, and any sample which becomes turbid should be rejected as unfit for consumption.

Reimann's Färber Zeitung,
No. 1, 1878.

In this issue is contained a notice of the progress of the recently-founded Dyer's Institute in Berlin, which appears to be in a satisfactory position.

No. 2, 1878.

This issue contains nothing of general interest.

No. 3, 1878.

It appears that though magenta made by the arsenic process is no longer used for colouring confectionery, syrups, liqueurs, &c., yet these articles are still found to contain traces of the poison. According to Ritter, of Rouen, the source of this evil is to be sought not in the magenta or other colours employed, but in the glucose or starch-sugar so often used. This substance is obtained by the action of dilute sulphuric acid upon starch; and the acid being made from arsenical pyrites contains traces of arsenic, which thus finds its way into articles of food. As in Germany the brewers employ little malt and very much starch-sugar, the beer is thus liable to be contaminated.

Justus Liebig's Annalen der Chemie,
Band 190, Heft 1 and 2.

The Application of Ammonium Sulpho-Cyanide in Volumetric Analysis.—J. Volhard.

Volatility of Barium, Strontium, and Calcium.—Prof. J. W. Mallet.—The author finds that of the three metals just mentioned calcium is the most volatile and barium the least so. Whether lime and baryta are reduced by the vapour of sodium at very elevated temperatures is still undecided.

On Certain Compounds of the Amine Bases with Hydro-Ferrocyanic Acid.—Emil Fischer.—The author has obtained several complicated compounds by the action of ferrocyanides upon tetra-methyl-ammonium iodide, dimethyl-ethyl-phenyl-ammonium hydroxide, and diethyl-phenyl-azonium bromide.

Studies on the Phosphates.—E. Erlenmeyer.—The first of this series of papers treats of the phosphates of manganese. The authors (MM. Erlenmeyer and Heinrich), after an historical survey of previous researches on the same subject, describe the mono-mangano-phosphate, the dinitri-mangano-phosphate, the di-mangano-phosphate, and the tri-mangano-phosphate.

Potassium Xanthogenate as a Means for the Quantitative Determination of Carbon Bisulphide, Copper, and Caustic Alkali, in presence of Alkaline Carbonates.—Dr. E. A. Grete.—For the determination of the xanthogenate the weighed substance, dissolved in water, is titrated with a decinormal solution of copper. The yellow cupric xanthogenate, even in very dilute solutions, on prolonged stirring, is easily deposited in flocks, and the liquid becomes so clear that a further addition of the copper solution causes a slight turbidity readily perceptible at the side of the beaker, and which on further agitation is taken up by the pre-existing precipitate. The following precautions are needful:—The precipitation must never be attempted in very concentrated solutions. The process is greatly accelerated by the application of heat. For the determination of free carbon bisulphide a portion of the sample is weighed in a bulb-tube, which is then broken beneath the surface of an alkaline solution of potassa in a beaker, when the entire quantity is converted into xanthogenate of potassa. The solution is mixed with solution of bitartrate of potassa till neutralised, diluted if needful, and titrated with decinormal solution of copper. If the CS_2 is present in an impure state in the air, in gas, or in soils which have been treated with sulpho-carbonates and xanthogenates, the carbon bisulphide is distilled or aspired into a Will-Varrentrapp apparatus containing a few c.c. of alcoholic potassa lye, and titrated after the treatment above mentioned.

MISCELLANEOUS.

The Chemical Society's Research Fund.—The following grants have just been made from the Research Fund of the Chemical Society:—To Dr. Wright, for the continuation of his researches "On Chemical Dynamics," £50. To Dr. Armstrong £25, for an "Investigation of Camphor and Allied Bodies." To Dr. Carnelly, of Owens College, £20, for a research "On the Hydrocarbons Diphenyl, Ditolyl, Tolyl-phenyl, &c., and their Derivatives." To Mr. P. Phillips Bedson, of Owens College, £10, for a research "On Phenyl-acetic Acid and on the Constitution of Isatin." And to Mr. J. R. Crow, of Owens College, £5, for a research "On the Action of Zinc Ethyl on the Chloride of Vanadium."

MEETINGS FOR THE WEEK.

MONDAY, 11th.—Medical, 8.
—— Royal Geographical, 8.30.
—— London Institution, 5.
—— Society of Arts, 8. "Explosions in Coal Mines," by Thomas Wills, F.C.S.
TUESDAY 12th.—Civil Engineers, 8.
—— Royal Institution, 3. "Protoplasmic Theory of Life, and its Bearing on Physiology," Professor Garrod.
—— Photographic, 8. (Anniversary).
—— Anthropological, 8.
WEDNESDAY, 13th.—Society of Arts, 8. "The System of Cremation in Use upon the Continent," W. Eassie, C.E.
THURSDAY, 14th.—Royal, 8.30.
—— Royal Institution, 3. "Chemistry of the Organic World," Prof. Dewar.
—— Royal Society Club, 6.30.
—— London Institution, 7.
—— Society of Arts, 8. "Recent Improvements in the Metallurgy of Nickel," A. H. Allen, F.C.S.
FRIDAY 15th.—Royal Institution, 8. Weekly Meeting. "Zoological Distribution and some of its Difficulties," Dr. P. L. Sclater, 9.
—— Geological 1. (Anniversary).
SATURDAY, 16th.—Royal Institution, 3. "Carthage and the Cartbaginians," R. Bosworth Smith, M.A.
—— Physical, 3. "On Grove's Gas Battery," H. F. Morley, M.A., B.Sc. "On the Drawing of Lissajous' Figures for the Stereoscope by his Pendulum Apparatus," S. C. Tisley. On the Same, Mr. Strop.

WATER ANALYSIS.—Prof. WANKLYN, Lecturer on Chemistry and Physics at St. George's Hospital, Public Analyst for Buckinghamshire, Buckingham, High Wycombe Peterborough, and Shrewsbury, has REMOVED to 7 Westminster Chambers, Victoria Street, S.W

COMPOSITION AND QUALITY OF THE METROPOLITAN WATER.

JANUARY, 1878.

THE following are the returns of the Society of Medical Officers of Health:—

	Appearance in 2 foot Tube.	Ammonia. Saline.	Ammonia. Organic.	Nitrogen as Nitrates, &c.	Oxygen used to Oxidise Organic Matter.	Total Solids.	Lime.	Magnesia.	Chlorine.	Sulphuric Anhydride.	Hardness on Clark's Scale. Before Boiling.	Hardness on Clark's Scale. After Boiling.
		Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs
Thames Water Companies.												
Grand Junction	Clear	0·000	0·009	0·090	0·114	24·40	8·230	0·460	0·78	1·760	13·2	3·70
West Middlesex	Clear	0·000	0·008	0·126	0·142	21·20	8·280	0·430	0·87	1·930	14·8	3·70
Southwark and Vauxhall	Slightly turbid	0·002	0·009	0·126	0·060	21·40	8·680	0·420	0·87	1·800	13·7	3·70
Chelsea	Clear	0·002	0·009	0·150	0·053	21·40	9·290	0·540	0·87	1·700	14·8	3·70
Lambeth	Slightly turbid	0·002	0·007	0·150	0·073	21·40	8·900	0·500	0·91	1·860	14·3	3·70
Other Companies.												
Kent	Clear	0·001	0·004	0·345	0·009	27·40	11·200	0·680	1·37	2·830	18·8	5·50
New River	Clear	0·001	0·008	0·135	0·025	21·90	8·960	0·420	0·87	1·030	15·4	2·80
East London	Clear	0·000	0·006	0·060	0·047	20·90	7·780	0·680	1·01	2·000	12·6	4·20

The quantities of the several constituents are stated in grains per imperial gallon.

NOTE.—The amount of oxygen required to oxidise the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the Metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it

C. MEYMOTT TIDY, M.B

Now ready, 8vo., cloth, 30s.

PHOTOGRAPHED SPECTRA. One Hundred and Thirty-six Photographs of Metallic, Gaseous, and other Spectra, printed by the permanent autotype process, with Introduction, Description of Plates, and Index; and with an extra plate of the Solar Spectrum (showing bright lines), compared with the Air Spectrum, by J. RAND CAPRON, F.R.A.S.

London: E. and F. N. SPON, 46, Charing Cross.
New York: 446, Broome Street.

Chemical Technology, or Chemistry in its Applications to the Arts and Manufactures. By THOMAS RICHARDSON and HENRY WATTS. Second Edition, illustrated ith numerous Wood Engravings.

Vol. I., Parts 1 and 2, price 36s., with more than 400 Illustrations.

Nature and Properties of Fuel: Secondary Products obtained from Fuel: Production of Light: Secondary Products of the Gas Manufacture.

Vol. 1., Part 3, price 33s., with more than 300 Illustrations.

Sulphur and its Compounds: Acidimetry: Chlorine and its Bleaching Compounds: Soda, Potash: Alkalimetry: Grease.

Vol. I., Part 4, price 21s., 300 Illustrations.

Aluminium and Sodium: Stannates, Tungstates, Chromates, and Silicates of Potash and Soda: Phosphorus, Borax: Nitre: Gun-Powder: Gun Cotton.

Vol. I., Part 5, price 36s.

Prussiate of Potash: Oxalic, Tartaric, and Citric Acids, and Appendices containing the latest information, and pecifications relating to the materials described in Parts 3 and 4.

BAILLIERE AND Co., 20, King William Street, Strand.

OFFICE FOR HOLLAND FOR CHEMICAL ANALYSES, NEW INVENTIONS, AND PATENTS
146, Spuistraat, Amsterdam.
Branch in London.
Director—Dr. P. F. VON HAMEL ROOS.

Bar Magnets, 4 ins. by 3-8ths, 2s 6d. the pair. Ferrotype Discs, 1s. per pair. Box-wood Reels, wound with No. 36 wire, 3s. the pair. Binding-screws, 3s. the dozen. No. 36 Silk-covered Wire, 4s. the ¼ lb. Double-line Wire, 2d. per yard: best quality ditto, 3d. per yard. Flexible Silk Double-Wire Cord, 4d. and 8d. per yard. Small Electric Bells, 7s. 6d. each. Electric Call-Bell, with Key, Switch, and Battery complete, £3 the two sets; Magnetic ditto, £4 4s. Orders over 5s. post or carriage free; EDWARD PATERSON, Electric Bell Works, 3, Bedford Court, Covent Garden, W.C. Illustrated Catalogue for Two Stamps.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.
Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.
The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.
Especial facilities or persons preparing for Government and other examinations.
Private Pupils will find every convenience.
Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.
Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

J. I. HEADLY, ENGINEER, Cambridge, Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

PATENTS. PATENTS.
ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

DO YOUR OWN PRINTING.
The "Optimus" Printing-Press for Amateurs. Prices 14s., 21s., 28s. Very simple and effective, and will print the finest work. Specimens and particulars, one stamp. A. HERBERT, Printing Warehouse, 50, Finsbury Square, London, E.C.

S. A. SADLER,
CLEVELAND CHEMICAL WORKS,
MIDDLESBROUGH;
Newfall Tar Works, Carlton;
and Ammonia Works, Stockton-on-Tees.
And also of the Furness Tar Products Co., Ulverston.

Manufacturer of Benzole, Toluole, Xylol Solvent and Burning Naphthas, Carbolic Acid and Disinfecting Powder, Refined Anthracene, Naphthaline, Black Varnish, Refined Tar, Crude Liquid Ammonia, Galvanising Salts, Coal-Tar, Pitch, Creosote, Grease, &c., &c.
S. A. S. is always a buyer of Coal-Tar Naphthas, Crude Anthracene and all Tar Products.
All communications to be addressed to the offices at Middlesbrough.

MILTON CHEMICAL WORKS,
STOKE-ON-TRENT,
STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.
N.B.—J. H. being a large manufacturer of the above can offer Special Advantages to Shippers, Merchants and Consumers, &c.
Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ar wick Chemica Works Manchester.

H. M. CAPNER,
Electrical and Philosophical Instrument Maker to the Trade only.
20, NORTHAMPTON SQUARE, LONDON E.C

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the ollowing terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays..	..	£2	2	0
200 Specimens, in Cabinet, with 5 Trays..	..	5	5	0
300 Specimens, in Cabinet, with 9 Drawers	..	10	10	0
400 Specimens, in Cabinet, with 13 Drawers	..	21	0	0

More extensive Collections at 50 to 5000 Guineas each.

F. Chemiker, Techniker, Fabrik., Ingenieure, Apotheker, Aerzte, Landwirthe. Chemisches Central-Annoncenblatt. Erscheint wöchentl. Durch j. Postanst. u. Buchhdl. zu beziehen. Preis viertelj. 2,50 M., durch Streifb. 3 M., nach dem Auslande 4,00 M. ANZEIGEN: 30 Pf. p. Zeile. Probenummern kostenfrei!

THE NEW MINIATURE SPRENGEL PUMP.
(STEARN AND SWAN'S PATENT.)
As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove, and the cleanliness of application makes this one of the marvels of household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, Londo

THE CHEMICAL NEWS.

Vol. XXXVII. No. 951.

METHOD OF OBTAINING THE COPPER FROM COPPER PYRITES WITH THE AID OF TWO WASTE PRODUCTS.

By HUGH M. WILSON.

The burnt ore obtained from the pyrites kilns is treated with waste chloride of manganese liquor from the chlorine stills, which is pumped on to a layer of the ore several successive times. A large portion of the copper contained in the ore is thus extracted by means of the free acid always present in the still liquor. The chloride of copper solution is then run on to a sufficient quantity of soda-waste to convert the whole of the copper into sulphide by means of the sulphuretted hydrogen disengaged from the waste. The manganese and calcium salts now in solution can easily be separated from the sulphide of copper, which is thrown on to a drainer, well washed, and afterwards heated on iron plates in order to convert it into sulphate of copper, which is then treated with boiling-water and allowed to crystallise.

At chemical works where the chloride of manganese liquor is treated according to Weldon's method a modification of the above would be necessary, as that liquor could not in that case be employed. The burnt ore might be ground fine and calcined with common salt in a blind roaster furnace, and then, after separating the copper chloride by lixiviation, the treatment continued with above described.

The pyrites used in charging the burners for the above process should be treated in the following manner:—

The large lumps are crushed in a stone-crushing machine, and the dust and smaller portions sieved away from the larger pieces, which are then ready for use. The dust and smaller lumps are ground into a paste with water, spread on iron plates, and allowed to dry at a gentle heat. Before the mixture of pyrites and water is dry it can be marked out into the required size for charging the kilns, viz., about two inches square. The sulphur ore thus prepared has the advantage of being uniform in size, of burning spontaneously as it were, no additional heat being required to decompose it when once the burners are red hot, and of costing no more to obtain it in that form than by adopting the ordinary process of breaking the large lumps with hammers.

A modification of the process described is being carried on on a small scale; but it is not generally known, or it would be extensively adopted, owing to the simplicity and efficiency of its nature.

Heaton Mersey, January 31, 1878.

SOME REMARKS ON THE METAL DAVYUM.

By SERGIUS KERN, M.E. St. Petersburg.

Unfortunately, the quantity of davyum in the hands of the author is still so small that no serious experiments can be made. Most of the platinum ores used during the investigations contain 0·0008—0·001 per cent. of davyum, and only a few of certain ores contain 0·035—0·045 per cent., as the author mentioned before (Chemical News, vol. xxxvi. p. 114). The reactions of davyum were again carefully examined, and the uniformity of the davyum received was confirmed by analysing the metallic residue obtained by igniting the double ammonium compound of davyum. No foreign metals were present. The metallic residue just mentioned was strongly ignited in a porcelain tube, through which a free current of pure oxygen was passed. The osmium and ruthenium, if they were present, were obliged to fly away in the form of OsO_4 and RuO_2. The davyum, which was found to contain no metals of other groups, was dissolved in aqua regia. The reactions of the davyum solution with KHO, KNO_2, KCyS were again examined.

The reactions of davyum with these reagents were found to be the same as mentioned in one of the author's former papers (Chemical News, vol. xxxvi. p. 155). If these reactions are compared with the similar reactions of iridium, platinum, rhodium, and palladium, the difference between them may be seen at once. (From osmium and ruthenium the davyum was liberated by the above-mentioned Fremy's process, used by him for the treatment of osm-iridium ore). The reaction of davyum with hydrogen sulphide was more closely examined: in acid solutions a brownish precipitate is immediately produced, which being dried turns black. The precipitation is complete. The davyum sulphide is soluble in aqua regia; ignited, it turns light brownish, and then is insoluble in aqua regia.

The author having at present only a very small amount of the metal, is desirous of investigating the davyum further when a sufficient quantity of it will be extracted. This, of course, demands much time, labour, and expense, owing to the rarity of the davyum.

APPLICATION OF ORGANIC ACIDS TO THE EXAMINATION OF MINERALS.

By H. CARRINGTON BOLTON.

(Continued from p. 25).

(3.) The organic acids employed in this investigation were chiefly citric, tartaric, and oxalic; a few tests were made also with malic, formic, acetic, benzoic, pyrogallic, and picric acids. Of the solid acids, solutions saturated in the cold were used, unless otherwise specified; of the liquid acids, ordinary commercial products. The behaviour of the minerals with these acids was studied in a very simple manner:—The mineral to be examined was carefully freed from its associated gangue or mineral, finely pulverised in an agate mortar, and a portion placed in a test-tube; the solution of the acid was then added, and the resulting phenomena, in the cold and on boiling, carefully noted Sometimes satisfactory conclusions were reached only by comparison of a number of tests under varying conditions, as to amount of acid, time of heating, &c. In some cases, to be mentioned in due course, the partial decomposition of the mineral was ascertained by filtering from the residue and testing the solution with an appropriate reagent; in others, by examining the disengaged gas with a suitable test-paper.

Carbonates.

(4.) The natural carbonates dissolve with effervescence more or less readily in dilute and strong, cold and hot solutions of citric, tartaric, oxalic, malic, formic, benzoic, acetic, pyrogallic, and picric acids, the relative power of these acids being approximately in the order in which they are named. The behaviour of the carbonates with citric acid may be summarised as follows:—

(*a*) Calcite, gurhofite, witherite, strontianite, cerussite, baryto-calcite, and malachite dissolve rapidly in the cold.

(*b*) Dolomite, ankerite, rhodochrosite, Smithsonite, and azurite, are more feebly attacked in the cold.

(*c*) Magnesite and siderite are not attacked in the cold.

On heating, all the above carbonates dissolve very rapidly, except siderite, which is more slowly attacked.

From strong, nearly neutral, solutions of calcite, gurhofite, and some other calcium minerals, a white precipitate of calcium citrate forms on cooling; cerussite also deposits a white precipitate on cooling.

It is evident that a solution of citric acid effects the decomposition of mineral carbonates with sufficient ease to render it extremely useful where hydrochloric acid can not be conveniently employed. The organic acid acts, however, somewhat more slowly; in fact, time appears to be an important factor in studying these reactions. On some minerals the organic acid has at first no effect, and an appreciable time elapses before bubbles of carbonic anhydride appear, indicating the decomposition of the mineral; this is especially noticeable with dolomite and azurite. The time of incipient action varies also with the acid employed.*

Owing to the viscosity of a concentrated solution of citric acid the liberated gas has difficulty in escaping, and often remains attached in bubbles to the powder until sufficiently large bubbles have formed to ascend through the syrupy liquid: this, of course, has reference to examinations made in the cold. Moreover, the precaution was observed of distinguishing between the escape of bubbles of air entangled by the powdered mineral and a true liberation of carbonic anhydride. These minute details are mentioned, because observation of them is necessary to obtain the same results as those recorded in the first part of this section. Magnesite and siderite were repeatedly tested, and always refused to effervesce with a cold solution of citric acid, a reaction which distinguishes them from other carbonates.

5. In making this investigation we have constantly borne in mind the possible employment of the methods in the field, and have conducted the tests in the simplest manner with that end in view. Since it is seldom convenient in field work to obtain the minerals in fine powder, an examination was made of the action of citric acid on the *massive* carbonates: and by way of comparison the behaviour of the same with hydrochloric acid was also noted. The results may be summarised as follows:—(1) Signifying that the minerals effervesce quickly when the acid is dropped on their smooth surfaces; (2) that they are feebly and slowly attacked; (3) that they do not effervesce.

Mineral.	HCl. Sp. Gr. 1·055.	Citric Acid.
Calcite	1	1
Dolomite	3	3
Gurhofite	1	1
Ankerite	2	3
Magnesite	3	3
Siderite	3	3
Rhodochrosite	3	3
Smithsonite	2	3
Witherite	1	2
Strontianite	1	2
Baryto-calcite	1	2
Malachite	1	2
Azurite	2	?

Porous minerals, and those having highly polished cleavage or crystalline surfaces, appear to resist the action of the acids, but for very different reasons; the former (smithsonite, for example) absorb the liquid and conceal its action within their pores; the latter (dolomite, siderite, &c.) seem to repel the liquid, or rather to prevent its actual contact. In the latter case the action of the acid may be rendered visible by scratching the surface with a knife and applying the acid liquid to the roughened surface or to the small amount of powder produced by the scraping. The observations above recorded were made on smooth surfaces.

In earthy minerals, the acid should be applied repeatedly at the same point until, the pores being filled, the action of the acid on the surface becomes apparent.

6. The mineral carbonates behave with a solution of tartaric acid much in the same manner as with citric acid, but the tartrates being in general a little less soluble than the citrates, crystalline precipitates form more readily on cooling the saturated solutions.

The results recorded below were obtained with a solution saturated in the cold:

(*a*) Calcite, gurhofite, witherite, strontianite, cerussite, and baryto-calcite dissolve readily in the cold; on boiling, the action is increased, and the solutions deposit crystalline precipitates on cooling; the precipitates of calcium tartrate and of barium tartrate form readily, and may be recognised with a little experience.

(*b*) Dolomite, ankerite, rhodochrosite, smithsonite, malachite, and azurite effervesce feebly in the cold, and dissolve rapidly on heating. Dolomite and smithsonite deposit crystals on cooling the solutions; malachite yields a bluish green precipitate; azurite dissolves readily without residue.

(*c*) Magnesite and siderite are not attacked in the cold, but dissolve readily on heating. The specimen of siderite from Roxbury effervesced very slightly in the cold and appeared to be more soluble than the specimen from Dauphiny.

7. Oxalic acid decomposes the carbonates in a similar manner, forming, however, still more insoluble precipitates, which are in some cases characteristic of the bases contained in the minerals; especially is this true of the white pulverulent calcium oxalate, the light yellow granular ferrous oxalate, the beautifully feathered crystals of barium oxalate, and the heavy white precipitate of lead oxalate. Ankerite contains enough ferrous carbonate to communicate a decided yellow colour to the insoluble calcium salt, by the formation of ferrous oxalate. Baryto-calcite dissolves freely on boiling, with formation of insoluble calcium oxalate; by decanting the supernatant liquid it deposits as it cools the feathered needles characteristic of acid barium oxalate, easily distinguishable from the stouter, lengthened, monoclinic prisms of oxalic acid which likewise form in concentrated solutions.

Magnesite, which resists the action of cold citric and tartaric acids, succumbs to oxalic acid. Siderite is also more readily decomposed. Malachite and azurite are feebly attacked in the cold, dissolve slowly on heating, and yield precipitates, which are respectively—grayish green and bluish white in colour. Cerussite and smithsonite also furnish solutions which deposit crystalline precipitates on cooling.

8. Acetic acid does not act so enegetically on the mineral carbonates as do the preceding; moreover, on boiling, the volatile acid distils off and the solution becomes weaker as the heating is continued; whereas with solutions of the solid acids, boiling increases their concentration and their decomposing power. We conjecture that experimenters in this direction have been deterred from further research by the unsatisfactory nature of the reactions with acetic acid. And yet, if we may trust the ancient chronicles of Rome, the behaviour of minerals with this acid was investigated at a very early period; we refer to that much disputed tradition which represents the celebrated Carthaginian general, Hannibal, applying vinegar to the removal of rocks that obstructed his passage across the Alps, in his march on the Roman capital:—

"Diducit scopulos et montem rumpit aceto."*

Glacial acetic acid does not in the slightest degree dissolve calcite; even pure precipitated calcium carbonate

* The interesting subject of the Velocity of Chemical Reactions has recently been investigated in certain cases by Boguski and Kajander (*Berichte der Deut. Chem. Gesell., Berlin*, ix., 1646, and x., 31). They find that when nitric, hydrochloric, and hydrobromic acids, of the same concentration, act upon marble, the velocity of evolution of carbonic anhydride is inversely proportional to their molecular weights. Cf. *American Journal of Science* [3], xii., p. 299. It will be interesting to ascertain whether this law holds good with organic acids.

* Juvenal, Satire X.

does not effervesce when boiled with glacial acetic acid; but on adding one-fourth part of water, effervescence begins at once and the carbonate dissolves freely.

The behaviour of carbonates with acetic acid may be summarised as follows (sp. gr. of acid = 1·037).

(*a*) Calcite, gurhofite, witherite, cerussite, baryto-calcite, and strontianite effervesce freely in the cold and dissolve rapidly on heating.

(*b*) Dolomite, ankerite, smithsonite, and azurite effervesce slightly in the cold, the action being increased on boiling.

(*c*) Magnesite, siderite, rhodocrosite, and malachite are not attacked in the cold, and dissolve more or less readily on boiling.

9. Formic acid (sp. gr. = 1·060) acts rather more powerfully than acetic; cerussite gives a peculiarly beautiful and characteristic deposit of lustrous white crystals. Malic acid also acts quite energetically; but the difficulty of obtaining it in a state of purity, and its high price, will prevents its use in this connection. It does not seem especially desirable to extend the list of organic acids; for though their number is legion, but few are commercial articles; some interest might be attached to a comparison of their decomposing power, but a practical application to the examination of minerals is very doubtful. To test the probabilities of their action, however, a few experiments were made with solutions of picric, benzoic, and pyrogallic acids.

A strong hot solution of picric acid (carefully freed from nitric acid by re-crystallisation) decomposes calcite, dolomite, and witherite very readily. A moderately strong hot solution of benzoic acid dissolves calcite freely, and a crystalline precipitate falls on cooling. Dolomite dissolves on boiling. Pyrogallic acid attacks calcite in the cold, and dissolves it on boiling, with formation of a white precipitate, while the supernatant liquid turns dark in colour through absorption of oxygen.

(To be continued)

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, February 7, 1878.

Dr. J. H. Gladstone, F.R.S., President, in the Chair.

After confirmation of the minutes, &c., the names of the following gentlemen were read for the first time:—T. W. Drinkwater, S. A. Goldschmidt, W. J. Macadam, S. S. O. Morris, W. A. H. Naylor, A. N. Pearson, and J. Spencer. The following were duly elected Fellows of the Society:—T. C. Cloud, G. F. Dowdeswell, A. Ginders, H. R. Hind, J. Woodland, S. P. Pickering, T. F. Harris, G. H. Spring, W. J. Williams, G. S. Taylor, A. Linnell, J. V. Elsden, A. H. Elliott, C. B. Fox, A. Jamieson, A. H. Hooker, D. A. Louis, W. Watson, W. H. Ellis, J. Hadkinson, W. D. Harland, R. Bodmer, H. B. Nason, G. E. Stodart, and G. Kühnemann. Mr. E. C. Gill was elected an Associate.

The first paper was entitled, "*The Alkaloids of the Aconites: Part II. On the Alkaloids contained in Aconitum Ferox*," by Dr. Wright and Mr. Luff. The alkaloid obtained from *A. Ferox* differs from that extracted from *A. Napellus* in that the latter, aconitine, yields well-crystallised salts with facility, whilst the former, pseudaconitine, forms crystallisable salts with difficulty. Aconitine under certain conditions loses the elements of water, forming a crystallised anhydro-derivative. When saponified aconitine breaks up as follows:—

$$C_{33}H_{43}NO_{12} + H_2O = C_7H_6O_2 + C_{26}H_{39}NO_{11},$$

benzoic acid and a new alkaloid being formed. Pseudaconitine likewise forms an anhydro-derivative, but by the action of saponifying agents it forms dimethyl-protocatechuic acid, and a new alkaloid quite different to that produced from aconitine. The formula of pseudaconitine is $C_{36}H_{49}NO_{12}$; a formula previously given, having O_{11}, was rendered inaccurate by the presence of some of the anhydro-derivative, apo-pseudaconitine, $C_{36}H_{47}NO_{11}$. Pseudaconitine was obtained from the roots of *A. Ferox* by percolating with alcohol acidulated with 0·05 per cent (by weight) sulphuric acid. The impure product from this process was dissolved in ether, filtered, mixed with about half its bulk of light petroleum, and crystallised, some resinous matter was removed by alcohol, and the purified alkaloid re-crystallised several times. By analysis the following numbers were obtained:—C, 63·09; H, 7·47; N, 2·12; theory requires—C, 62·88; H, 7·13; N, 2·04. By conversion into the nitrate, re-crystallisation, and reconversion into nitrate, the following numbers were obtained:—C, 62·71; H, 7·44; N, 2·07; Au in the gold salt, 19·24; theory requiring Au, 19·10. A determination of nitrogen by combustion with oxide of copper and metallic copper in a Sprengel vacuum, &c., gave 2·06 N. Pseudaconitine is far more soluble in alcohol and ether than aconitine; it forms transparent needles, and sandy crystals, but is apt to separate as a varnish if not evaporated extremely slowly. Air-dried, the crystals are hydrated; at 100° they lose their water with partial fusion. If the alkaloid be dissolved in just sufficient dilute warm nitric acid to form a nearly neutral salt, a few drops of concentrated nitric acid be added and the whole stirred vigorously, crystallisation takes place. The sulphate, hydrochloride, acetate, oxalate, &c., will not crystallise. The gold salt of pseudaconitine is distinctly crystalline, $C_{36}H_{49}NO_{12}.HCl.AuCl_3$. Pseudaconitine is sparingly soluble in water; it crystallises with H_2O, and melts at 104° to 105°. Aconitine crystallises anhydrous; melts at 189°. By heating to 105° a new uncrystallisable base is formed containing—C, 65·51; H, 7·5. A similar substance is obtained by heating the acetate to 130° to 140°. When heated to 100° in a sealed tube with alcoholic soda for twelve hours, pseudaconitine splits up into dimethyl-protocatechuic acid and a new base pseudaconine, $C_{36}H_{49}NO_{12} + H_2O = C_9H_{10}O_4 + C_{27}H_{41}NO_9$. The reaction takes place without a sealed tube in twenty-four hours, but more of a resinous by-product is formed. The reaction was investigated quantitatively. In melting-point and physical and chemical properties the acid agreed with dimethyl-proto-catechuic acid. The crude alkaloids obtained from *A. Ferox* on saponification yielded some benzoic acid, from which circumstance the authors think that it probably contained small quantities of aconitine, either present in *A. Ferox* or from the admixture of a few roots of *A. Napellus*. Pseudaconine does not crystallise; it is soluble in water, forming a strongly alkaline solution having a bitter taste, but not producing the slightest tingling; its analysis and properties are given. Saponifying agents, at temperatures above 100°, form dimethyl-protocatechuic acid and apo-pseudaconine, $C_{27}H_{39}NO_8$, which closely resembles pseudaconine. Dilute or concentrated mineral acids saponify pseudaconitine when heated with that substance. Tartaric acid forms apo-pseudaconitine. Inorganic acids, with certain precautions, also yield apo-pseudaconitine. Glacial acetic acid yields acetyl-apo-pseudaconitine; anhydrous acetic acid furnishes the same substance. Benzoic acid yields benzoyl-apo-pseudaconitine. The authors then give the constitutional formulæ of the above substances, and point out that pseudaconitine is closely related to the opium alkaloids narceine, narcotine, and oxy-narcotine, which all give rise to derivatives of dimethyl-protocatechuic acid; moreover, all the natural alkaloids which have been split up by saponification yield acids of the aromatic series. Other bases from the crude aconitine were isolated; in fact about one-fith of the commercial article consists of substances far less active than pseudaconitine. The authors therefore recommend that for medicinal use the alkaloid should be separated by con-

version into the nitrate, which is almost insoluble in 10 per cent nitric acid.

The President said that the Society was deeply indebted to Dr. Wright and Mr. Luff for their elaborate research, which they must have carried out at no small risk, the substances being of such a poisonous nature.

In answer to some critical remarks of Mr. Kingzett, Dr. Wright stated that he wished to withdraw a statement made by him at the Pharmaceutical Conference, viz., "that the alkaloid obtained by Dr. Paul and Mr. Kingzett from Japanese aconite was pseudaconitine."

The next communication was entitled, "*Notes on the Tannins*," by Dr. Paul and Mr. Kingzett. The authors during the examination of various tannins completely verified the statement of H. R. Procter, that no two processes for the estimation of tannin give similar or comparable results, although, when the same process is used against products of the same nature, the results are tolerably constant; *i.e.*, cutch can be compared with cutch, mimosa with mimosa, &c., but not cutch with tannin, or mimosa with cutch. The term tannin includes not one common substance, but several astringent principles obtained from different plants. After detailing experiments the authors conclude that (1) the supposition that natural tannin from gall-nuts is a glucoside is rendered doubtful; (2) the astringent principle common to cutch and extract of mimosa bark is a glucoside, and yields on decomposition unfermentable sugar and a peculiar acid distinct from gallic acid.

The next paper was read by Mr. E. Riley, "*On the Estimation of Phosphorus in Iron and Steel.*" The author instituted a series of experiments as to the relative values of the two methods of determining phosphorus in iron, the molybdate and the magnesia processes. The analyses were carried out by several experimenters working independently, and as a general result the author concludes that the molybdate process always gives too low a percentage, and that the magnesia method is the only one to be trusted. Some pure peroxide of iron, almost free from phosphorus, was carefully prepared, the trace present determined, and portions, after mixing with known weights of pure phosphate of magnesia, analysed; the results given by the magnesia method were quite satisfactory and concordant. The process as given by the author is as follows:—The substance is dissolved in strong hydrochloric acid, and after dilution, reduced with sodium sulphite, the excess of sulphurous acid expelled from the solution, which is then nearly neutralised with ammonia. Acetate of ammonia is added and the liquid boiled; the whole of the phosphoric acid in the solution is thus precipitated; if enough peroxide of iron is not present some dilute solution of perchloride must be added. The precipitate is filtered and the filter dissolved without washing in strong hydrochloric acid, and thoroughly washed. The solution of phosphoric acid with some iron is then evaporated to a small bulk, about 15 c.c.; to this 13 grms. of citric acid are added, the solution is neutralised with 0·960 ammonia, and 20 to 30 drops of magnesia solution added; then a moderate amount of 0·880 ammonia, so as to make the liquid strongly alkaline; the total bulk should not exceed 50 c.c. After standing two days and nights with occasional stirring, the precipitate is filtered off, washed with ammonia water, dried, ignited, and weighed. The paper contains many analyses.

Dr. Wright enquired if the molybdate precipitate was weighed directly, or was re-dissolved and precipitated.

Mr. Warington thought the low percentage of phosphorus with the molybdate process might be due to the presence of chlorides; they should be decomposed by evaporating to dryness with sulphuric acid. From the paper he should gather that too much citric acid had been used, otherwise the magnesia precipitate would come down completely in three hours.

Mr. Riley replied that if the molybdate precipitate had to be re-dissolved up, &c., he failed to see that it had any advantage either in time or accuracy over the magnesia method; that hydrochloric acid must be used for solution, and that unless 13 grms. of citric acid were used results would be obtained which were quite fallacious.

The next paper was read by the President, Dr. Russell taking the Chair, and was entitled, "*An Enquiry into the Action of the Copper-Zinc Couple on Alkaline Oxy-salts*," by Dr. Gladstone and Mr. Tribe. In 1873 Prof. Thorpe proved that the couple converts all the nitrogen of nitre in the presence of water into ammonia. The authors had previously observed that nitrites were first formed, and have now made an exhaustive study of the reaction. This chemical change starts somewhat energetically, then diminishes considerably, again increases, and finally ends more rapidly than it began. Ammonia and its equivalent of potash slowly increase from the commencement until the time when the maximum amount of nitrite is produced, when this salt rapidly breaks down, and is of course accompanied by an increasing amount of the alkalies. Solutions of ammonia containing 0·026 and 0·256 per cent increase the action of the couple, but stronger solutions diminish it. Solutions of potash from 0·08 to 60 per cent increase the change. By pouring a 10 per cent solution of nitre with enough copper sulphate to colour the liquid distinctly on to some granulated zinc in a tap funnel, and allowing it to remain a few seconds, enough nitrite is formed to give the characteristic green colour of copper nitrite, and to give a blue colouration with starch, potassium iodide, and acetic acid. The latter reaction can be used as a delicate test for nitrates; 5 c.c. of solution, 12 drops of copper sulphate, and 4 to 5 pieces of zinc foil, 1 by ½ inch; allow to stand for three minutes, then pour into 5 c.c. of the starch solution containing potassium iodide and acetic acid. On the whole the authors think that the following is the most probable explanation: that the two metals electrolyse the nitre with the formation of nitrate of zinc, the reduction being effected at the negative pole through the agency of the potassium. Many experiments were made, but without absolutely settling the question. By electrolysing, potassium nitrate solution in a V shaped tube zinc nitrate was formed in the zinc limb, and potassium hydrate with smaller quantities of potassium nitrite and ammonia in the copper limb. The copper-zinc couple converts potassium chlorate readily into potassium chloride. No chlorites or hypochlorites were formed. By electrolysing the greater part of the hydrogen escapes as gas instead of the potassium chlorate being converted into chloride, the reason being that with the couple the hydrogen is probably wholly occluded the moment it is set free; in electrolysis only a small quantity of the gas is condensed by the negative plate. The authors consider the following statements proved:—1. The action of the copper-zinc couple on these oxysalts is of an electrolytic nature. 2. The negative radical combines with the zinc, whilst the positive radical or its equivalent of hydrogen from decomposed water is set free against the copper crystals. 3. The reduction and hydrogenisation of the salt take place in the immediate vicinity of the negative metal; also, it is probable that hydrogen is actually set free against the copper, but is condensed by the finely-divided metal, and in that condition does its work of reduction and hydrogenisation. The action of the couple on ammonium nitrate was found to be substantially the same. If the reaction be attempted at or near the boiling-point the nitrite formed is decomposed, nitric oxide being evolved.

The last paper was by Mr. H. C. Jones, "*On a New Method for the Determination of Boiling-points.*" A piece of glass tube, 4 m.m. internal diameter and 200 m.m. long, is bent in a U, so that the one end which is open extends at least 15 m.m. beyond the other which is closed. The bend is made in the form of a circle about 20 m.m. in diameter. The liquid, two or three drops of which will be quite enough for the determination, is introduced into

the closed end of the U-tube; the open end is placed underneath the surface of some mercury contained in a small porcelain crucible. The whole is then slung by means of copper wire into a water or paraffin bath, and the temperature of the latter gradually raised. The liquid will of course boil and the vapour drive before it the air. On cooling, the whole tube, which the author calls a tension-tube, is filled with mercury, a bubble of liquid occupying the top of the bend. The tube is then inverted and the liquid transferred to the closed end of the tube. Any water or paraffin is now removed from the tube, and some mercury emptied from the open limb. The method of determining the boiling-point is as follows:—The tube is immersed in a paraffin bath, care being taken that the open end is freely exposed to the air. The temperature is then gradually raised, and as the temperature approaches the boiling-point of the substance, the mercury falls in the closed limb, the tube being gently tapped. At the moment the mercury levels in the two limbs are equal the temperature of the bath is taken by a delicate thermometer placed close to the liquid in the closed limb. The bath is allowed to cool, and the temperature at which the levels pass each other again noted; and so six observations are made, the mean of which gives the uncorrected boiling-point. Many determinations are given in the paper, which agree well with each other. The advantages of the method are obvious, the small quantity of the substance required being one of the most important. Moreover, the tension-tube can be labelled and put away for future verification. By using a spermaceti bath boiling-points up to 300° C. can be determined.

The Society then adjourned to February 21, when "A Lecture on Laboratory Experiences on Board the *Challenger*," will be given by Mr. J. Y. Buchanan.

NOTICES OF BOOKS.

Experimental Researches in Pure, Applied, and Physical Chemistry. By E. FRANKLAND, Ph.D. (Marburg), D.C.L., F.R.S., Professor of Chemistry in the Royal School of Mines. London: John Van Voorst. 1877.

THIS goodly volume, of more than a thousand pages, contains the researches of a man who can scarcely be said to have much passed the prime of life, and who has before him, as we hope and believe, a sufficiency of energy, of enthusiasm, and of lifetime to produce a second thousand pages of original matter. It is a good custom, and one which is fortunately on the increase, for a distinguished investigator to publish his researches during his lifetime. A compiler can never do justice to an author's work, which he collects and arranges; nor would it have been possible for any compiler to add the introduction to each chapter, showing its scope and general bearing, in the complete manner in which Prof. Frankland has performed this task. The researches extend over thirty years of active scientific work; they embrace original memoirs, Government reports, addresses, and lectures, and they are collected from various English and Foreign Transactions and Journals. The Pure Chemistry occupies ten chapters; Applied Chemistry, four chapters; and Physical Chemistry, four chapters; while the separate memoirs are no less than sixty-four in number.

The first chapter, of twenty-five pages, explains the system of notation adopted throughout the work, and is an embodiment of the memoir entitled "Contributions to the Notation of Organic and Inorganic Compounds," read before the Chemical Society in 1866. The author, so long ago as 1858, proposed the adoption of this system in a Royal Institution lecture, and he has for many years adopted it in his lectures. So enthusiastic is he, as to its value, that he affirms that "by means of this method students arrive at the same point in their curriculum in about two-thirds of the time necessary under the older systems." A complete table of atomicities is placed at the end of the chapter, in which nitrogen, phosphorus, vanadium, arsenic, antimony, and bismuth figure as pentads; while sulphur, selenium and tellurium, osmium and its associated metals, and the metals of the iron group appear as hexads. It is, we think, a little unsatisfactory to have to place nitrogen and the old members of the triad group away from boron and gold; while the placing of oxygen and sulphur in a separate group, and of sulphur in the same group with iron and manganese, should not be done without an overwhelming mass of cogent reasons. *Semi-molecule* is an ugly term, unless we change our usual definition of molecule; a *bond* is a strange expression for force acting along a line; and we cannot think that the "internal arrangement of the atoms composing alcohol," or any other substance, can be inferred, much less known. Yet these hypotheses, if accepted not too literally by the student, will no doubt enable him to group together large classes of facts with a facility which the older notation did by no means afford.

The second chapter discusses the "Transformation of Cyanogen into Oxatyl." The investigation was commenced by Kolbe and Frankland in 1847, and finished in the summer of the following year. At this time Frankland was only 22 years old, while Kolbe was scarcely 30. Their experiments led to the conclusion that it would be possible to prepare from the nitriles of propionic and butyric acids the corresponding and hitherto-unknown alcohols.

In the third chapter we find a discussion of the results of "The Action of Potassium upon Ethylic Cyanide," and of the "Polymerisation of Ethylic Cyanide." This investigation was also carried out in conjunction with Kolbe, in 1847-8. The main object of the experiments—the separation of the radical ethyl—was not effected, but unexpected results of great interest were obtained; and *ethylic hydride*, *cyanethine*, *nitrate of cyanethine*, and *cyano-platinic chloride* were obtained for the first time.

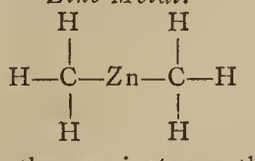
In Chapter IV. we have an account of the "Isolation of the Alcohol Radicals," an investigation commenced in the winter of 1847 at Queenwood College, and continued at Marburg and Giessen. Ethylic iodide was submitted to the action of potassium in closed tubes, at elevated temperatures; the gaseous products were found to consist of equal volumes of ethylene and ethylic hydride, according to the equation—

$$2C_2H_5I + K_2 = C_2H_4 + C_2H_6 + 2KI.$$

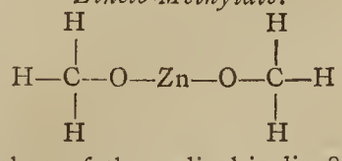
Zinc was then substituted for the potassium, and the radical ethyl was successively isolated (1848). Amyl was also isolated from its iodide; ethylic iodide was shown to be decomposed by solar light in the presence of mercury; and marsh gas was proved to be the first term of a new homologous series, viz., the hydrides of the radicals of the methyl series. Five new compounds were discovered during this investigation—*ethyl*, *ethylic hydride*, *amyl*, *amylic hydride*, and *amylene*.

Chapter V. details the author's important synthetical researches on organo-metallic bodies. The term *organo-metallic* was introduced to designate the members of a family of compounds which contain a "positive organic radical united *directly* with a metal." Such bodies are to be distinguished from those organic compounds which contain metals indirectly united to each other: thus zinc methyl is an organo-metallic body, while zincic methylate is an organic body containing a metal. This difference the author illustrates by his graphic formulæ in the following manner:—

Zinc Metal.



Zincic Methylate.



In the one instance the carbon of the radical is directly united with zinc, in the other it is indirectly united with

the zinc by the dyad oxygen. Zinc ethyl and zinc methyl were discovered on July 12th, 1849, at Marburg. "After making the reaction for the isolation of methyl, by digesting methylic iodide with zinc, and after discharging the gases, I cut off the upper part of the tube, in order to try the action of water upon the solid residue. On pouring a few drops of water upon this residue, a greenish blue flame several feet long shot out of the tube, causing great excitement among those present. Professor Bunsen, who had suffered from arsenical poisoning during his researches on cacodyl, suggested that the spontaneously inflammable body, which diffused an abominable odour through the laboratory, was that terrible compound, which might have been formed by arsenic present as an impurity in the zinc used in the reaction, and that I might be already irrecoverably poisoned. These forebodings were, however, quelled in a few minutes by an examination of the black stain left upon porcelain by the flame; nevertheless I did afterwards experience some symptoms of zinc-poisoning." Zinc amyl was afterwards prepared in Liebig's laboratory at Giessen, and further work on organo-metallic bodies was continued by Prof. Frankland in the laboratories of the College of Civil Engineers at Putney, Owens College, Manchester, St. Bartholomew's Hospital, and the Royal Institution. In the course of this investigation it became evident to the author that the atoms of various bodies only permitted the attachment of a fixed and definite number of the atoms of other elements; and this observation constituted the basis of the doctrine of atomicities, or valency of elements. The hypothesis was communicated to the Royal Society on May 10th, 1852. The law of variation in the atomicity of elements was made several years later, and was first published in the author's "Lecture Notes for Chemical Students," in 1866. He explained it by the assumption that "one or more pairs of bonds belonging to an atom of the same element can unite, and, having saturated each other, become as it were latent." For example, pentad nitrogen becomes a triad when one pair of its bonds becomes latent, and a monad when two pairs become latent by combination with each other. In 1856 the author read a paper before the Royal Society "On a New Series of Organic Compounds containing Nitrogen." Ethyl was substituted for oxygen in nitric oxide, and methyl in sulphurous anhydride. Two years later Wanklyn procured acetic acid by the action of potassium methyl on carbonic anhydride. In this fifth chapter the discovery of no less than twenty-four new organic compounds is announced; twelve belonging to the zinc series—zinc ethyl, zinc amine, zinc oxamide, &c.; four to the mercury series—mercuric amylide, iodamylide, &c.; and eight belonging to the tin series—stannous ethide, stannic diethoxide, &c.

The sixth chapter is devoted to *organo-boron compounds*. Fourteen new compounds are described, three belonging to the methyl series, of which boric methide is the most important; and eleven belonging to the ethyl series, of which boric ethide is the most important. Then bodies were produced by the action of zinc ethyl and zinc methyl upon boric ethylate. The experiments extend over fourteen years, 1862 to 1876.

The next chapter gives an account of the author's "Synthetical Researches on Acids of the Lactic Series." The results were made known in 1866. No less than *twenty-nine* new compounds are described in the memoir: among these we find dimethoxalic acid, diethoxalic acid, amylethoxalic acid, diamyloxalic acid, and some of their compounds. These experiments naturally led to synthetical researches on acids of the acrylic series, which resulted in the discovery of fifteen new compounds—among them methacrylic acid, ethyl-crotonic acid, and cupric ethyl-crotonate.

The ninth chapter contains those papers relating to the synthesis of the acids, of the fatty or acetic series. In this, as in several of the preceding researches, the author worked conjointly with Mr. B. F. Duppa. The experiments resulted in the production of the higher members of the acetic or fatty series of acids by direct synthesis from acetic acid. Three distinct series of bodies were produced—(*a*) carbo-ketonic ethers, (*b*) ethereal salts of the fatty acids, and (*c*) ketones. Twenty-seven new compounds were produced.

The final chapter of this first division of the work, on "Pure Chemistry," gives an account of some miscellaneous work which was accomplished between 1853 and 1863. The first of these four papers relates to an improvement in apparatus for the analysis of gas; the second gives the analysis of many specimens of air from Mont Blanc, collected in 1859; the third describes a new method for the ultimate analysis of organic compounds containing mercury; while the fourth describes the behaviour of iron and steel when ignited in highly-compressed oxygen.

The second section of "Experimental Researches" relates to Applied Chemistry, and extends over nearly four hundred pages. The first chapter relates to *Artificial Light*, and embodies an account of experiments made at various times between 1852 and 1865. The first paper relates to the manufacture of hydrocarbon gas, and it contains comparisons between the illuminating power of common coal-gas as supplied to London in 1851 and in 1876. This is compared with the illuminating power of cannel-gas, which is supplied to the Houses of Parliament and Government offices only, and which has more than twice the illuminating power of ordinary gas: 1000 cubic feet of cannel-gas costs six shillings, and gives as much light as 2000 cubic feet of common gas, costing eight shillings. The second paper treats of the igniting point of coal-gas, and the experiments were made in reference to an explosion of gas which occurred in 1862. The third paper discusses the use of metallic magnesium as a source of light. Magnesium gives 265 times as much light as good coal-gas, with an absolute equal thermal effect; but the difference of price is so great that, at present at least, there is no chance of its superseding gas. The following shows the relative prices of magnesium, stearine candles, and gas, in order to obtain the same amount of light for ten hours:—

	£	s.	d.
2½ ounces of magnesium	1	6	3
20 lbs. of stearine candles	1	0	0
404 cubic feet of coal-gas..	0	1	9½

The four papers relating to artificial lighting is on a new form of gas-burner.

In the second chapter of the section on Applied Chemistry the very important subject of *Drinking Water* is fully discussed. The chapter extends over a hundred and thirty pages, and the experiments were made between 1865 and 1876. The whole subject is treated very exhaustively—the analysis of potable waters, the examination of the gases in waters, the development of Fungi, the comparative purity of different waters, methods of softening hard waters, and the deterioration of waters by passing through metal pipes. The chapter is of great value, not only from a chemical but also from a sanitary point of view.

The third chapter of this section contains papers on the purification of foul water. These enquiries were made at the request of the Government, at a time when (in 1859) the Thames was "a black, seething, and stinking canal, its sluggish waters being carried backwards and forwards by the tide between London and Westminster; and the stench in the Committee-Rooms of the Houses of Parliament became so unbearable as to render necessary the filtration of the outer air through cloths wetted with solution of chloride of lime." Afterwards a Royal Commission was appointed to inquire how the contamination of rivers by sewage and refuse matters can best be prevented or avoided altogether.

The fourth chapter gives an account of some miscellaneous work in connection with Applied Chemistry. The papers relate to the making of artificial milk; the influence

of atmospheric pressure on the burning of time fuses; on the gases existing in solution in well-waters; on the analysis of sea-water; and (1877) on the transport of solid and liquid particles in sewer gas.

The third section, and rest of the book, is devoted to researches in Physical Chemistry. Chapter I. describes a number of experiments which were made between 1859 and 1868 on "The Influence of Atmospheric Pressure on Combustion." The research had its origin in an ascent of Mont Blanc, and for the first time a night was spent on the very summit of the mountain. Some candles were burnt on the summit, and it was noticed that although the rate of combustion was the same as at Chamounix, the intensity of the light emitted was much less. On examining further into this question the author was led to deduce the following law:—"The diminution in illuminating power is directly proportional to the diminution of atmospheric pressure." A further set of experiments proved that many luminous flames do not contain solid particles. Thus the flame of hydrogen or carbonic oxide becomes strongly luminous if it be caused to burn under a pressure of from 10 to 20 atmospheres. It was, moreover, ascertained that a hydrogen flame which when burnt in oxygen, under a pressure of 3 atmospheres, gave 1 to 2 units of light, under a pressure of 12 atmospheres gave no less than 100 units.

The second chapter contains memoirs on the spectra of gases and vapours. The experiments were carried out in conjunction with Mr. Norman Lockyer, in 1861, and resulted in the discovery of the fact that the hydrogenous solar atmosphere, or chromosphere, possesses an extremely low density, and that hydrogen, nitrogen, and magnesium give simpler spectra when their temperature and density are reduced.

The third chapter of this section is "On the Source of Muscular Power." Fick and Wislicenus proved, in 1865, that muscular power is to a great extent produced by the oxidation of non-nitrogenous substances, such as fat. Frankland determined to put the matter beyond dispute by determining the amount of potential energy locked up in muscle, and its chief products of oxidation—urea, uric acid, and hippuric acid. A number of Tables are given in the memoir, showing the amount of actual energy developed by 1 grain of various articles of food when oxidised in the body. These Tables show that 0·55 lb. of fat will perform the work of 1·15 lbs. of cheese, 5 lbs. of potatoes, 1·3 lbs. of flour or pea-meal, or of 3½ lbs. of lean beef. The following conclusions were drawn from the author's results, coupled with those of Fick and Wislicenus:—

1. "A muscle is a machine for the conversion of potential energy into mechanical force.
2. "The mechanical force of the muscles is derived chiefly, if not entirely, from the oxidation of matters either contained in the blood or deposited around the muscular fibres, and not from the oxidation of the muscles themselves.
3. "In man the chief materials used for the production of muscular power are non-nitrogenous; but nitrogenous matters can also be employed for the same purpose, and hence the greatly increased evolution of nitrogen, under the influence of a flesh diet, even with no increase of muscular exertion.
4. "Like every other part of the body, the muscles are constantly being renewed; but this renewal is scarcely perceptibly more rapid during great muscular activity than during comparative quiescence.
5. "After the supply of sufficient albumenoid matters in the food of man to provide for the necessary renewal of the tissues, the best materials for the production both of internal and external work are non-nitrogenous matters, such as oil, fat, sugars, starch, gum, &c.
6. "The non-nitrogenous matters of food which find their way into the blood yield up all their potential energy as actual energy; the nitrogenous matters, on the other hand, leave the body with a portion (at least one-seventh) of their potential energy unexpended.
7. "The transformation of potential energy into muscular power is necessarily accompanied by the production of heat within the body, even when the muscular power is exerted externally. This is doubtless the chief, and probably the only, source of natural heat."

The final chapter of the section and of the book is on climate, and contains various memoirs on this subject, written between 1861 and 1877. The ideas contained in the first of these, "On the Physical Cause of the Glacial Period," have since been almost entirely abandoned by the author; but he still retains his ideas as to the ultimate fate of the world. He believes that in course of time, when the ocean has been absorbed into the cavities created by the cooling of the interior of the earth, the latter will become as the moon, a mere sterile waste. The second short paper is on the formation of ground ice; and the third relates to the operation of solar temperatures at Davos during the winter of 1873-74. Davos is a small village, situated in a valley 5352 feet above the sea, in Canton Graubingen, Switzerland. On December 21st the mercurial thermometer with blackened bulb *in vacuo* showed 44° C. in the sunshine at 10 a.m., and 45° C. at 2.50 p.m.; at Greenwich, on the same day, the blackened bulb thermometer showed 9·3° C. at 9 a.m., and 21·9° C. at noon and 3 p.m. On another occasion a plain mercurial thermometer, with a black glass bulb, placed in a box lined with padded black cloth and covered with plate-glass, registered 105° C. at 2 p.m. The author attributes the peculiar winter climate of Davos—(*a*) to its elevation above the sea, which secures greater transcalency in the atmosphere; (*b*) thick and permanent snow, which reflects the solar heat, and prevents the communication of warmth to the air, and consequently the production of winds; and (*c*) a sheltered position favourable for receiving both the direct and reflected rays. In a paper which is a continuation of the preceding a number of determinations of solar intensity are given, and it is shown that solar intensity at the surface of the earth is independent of the sun's altitude. With a clear sky the intensity is sometimes greater in Norway 4° south of the Arctic Circle than under the Equator with a nearly vertical sun. Two short notes, one on the Radiometer and the other on Halos, conclude the volume.

Without doubt the most valuable portion of Professor Frankland's work to the general community is that which relates to potable waters and to artificial illumination; the most interesting portion to the chemist is the account of the discovery of numerous organic compounds. The book is many-sided in its interest, and both to student and master it will be found of increasing value. Although abounding in facts, and some of them very complex facts, the style is excellent, and the book is most readable. It has also the advantage of a good index and of a few good illustrations. We trust the example of Prof. Frankland will be followed, and that other investigators will publish an account of their researches in a collected form and with all necessary explanations.

The Chemist and Druggists' Diary for 1878.—This useful annual, which has now reached the tenth year of its age, in addition to the usual Diary, contains a large amount of information useful to the pharmaceutical chemist. For instance, there is an excellent article on County Court process, in which a number of practical directions for suing small debtors are conveyed in plain, every-day language. A dictionary of chemical and pharmaceutical synonyms is the fullest compilation of the kind we have yet met with, and may be consulted with equal profit by the scientific chemist as well as the pharmacist.

CORRESPONDENCE.

ILLUMINATING POWER OF BENZOL, &c.

To the Editor of the Chemical News.

Sir,—In his letter (Chemical News, vol. xxxvii., p. 61) Dr. Dittmar, criticising two papers of mine which he had never seen, asserts (1) that I *claim credit* for having pointed out in 1852 that hydrogen, carbonic oxide, and marsh-gas contribute nothing to the luminosity of coal-gas, and that the only constituents of value were benzol, ethylene, propylene, butylene, and acetylene. (2) That Bunsen in 1857 did not know of the existence of benzol in coal-gas, and that as I came "fresh from Bunsen" in 1852, and have added nothing to what I had learned from my master, it followed that I also could not know of the existence of benzol in coal-gas until in 1876 I was informed of that fact by Berthelot, and had seen the *proof* of it by Dr. Dittmar.

The practice of criticising papers from inner consciousness is, in this country at least, not a common one, and the result of your correspondent's attempt is not encouraging. If Dr. Dittmar will read the paper by Mr. Thorne and myself (when it is printed) he will find the following to be the only sentence to which his first assertion can have any reference :—"As early as the year 1852 it was pointed out by one of us that hydrogen, carbonic oxide, and marsh-gas practically contribute nothing to the light of coal-gas, and that the only constituents of this gas having any substantial value as light-giving agents are those hydrocarbons which combine with fuming sulphuric acid.—*Mem. of Manchester Lit. and Phil. Soc.* 2nd series), vol. x., p. 71."

So far from *claiming credit* for pointing out in 1852 that H and CO give no light Dr. Dittmar will find, if he will take the trouble to consult my paper of that year, the following statement :—"It has always been maintained that H and CO possess no illuminating power, and that the light emitted by coal-gas is due to light carburetted hydrogen (marsh-gas), olefiant gas, and other hydrocarbons." What I did in 1852 was to distinguish sharply for the first time between the illuminating and non-illuminating constituents of coal-gas. Before that year marsh-gas had always been considered as one of the luminiferous constituents. Thus, Mr. John Leigh, the Chemical Adviser to the Corporation Gas Works in Manchester, and one of the best authorities on the chemistry of coal-gas, wrote in 1851*—"There remain as constant ingredients of the gas, as at present manufactured, hydrogen, light carburetted hydrogen, olefiant gas, volatile hydrocarbons, carbonic oxide, and a little nitrogen; and of these the olefiant gas, volatile hydrocarbons, and light carburetted hydrogen (marsh-gas) alone contribute to illumination." When, in 1849, I obtained absolutely pure marsh-gas by the action of water upon zinc-methyl, I was surprised at the non-luminous character of its flame: again, in 1851, I observed, in my investigations on the manufacture of gas, that the illuminating power of coal-gas was not lowered by the substitution of hydrogen for marsh-gas; and, lastly, by sinking an iron tube through the peat of Chatmoss, near Manchester, I found that the natural marsh-gas which flowed abundantly through this iron tube gave, when burnt as a fishtail flame, scarcely more light than hydrogen. I brought up bags of the gas to London, and showed its non-luminosity to a large audience at the Royal Institution.

Dr. Dittmar's second assertion is equally devoid of foundation, for since the discovery and isolation of benzol in the liquid deposited from compressed gas by Faraday in 1825, and its subsequent extraction from coal-tar, the presence of benzol in coal-gas has, I presume, been known to all chemists. I cannot remember when I did not know it; and Mr. Leigh, in the paper just quoted, gives benzol with the formula $*C_{12}H_6$ in a tabular list of the constituents of coal-gas. The assertion that Bunsen did not know it in 1857 is too preposterous for comment. From the notes of my lectures on technical chemistry, delivered at Owens College in the session 1853-54, I copy the following :—"Constituents of purified gas are H, CH_2 (marsh-gas), CO, gases and vapours having the formula $*C_n H_n$, and vapours $C_n H_{n-6}$. . . . Vapours of the formula $C_n H_{(n-6)}$, benzole, toluole, cumole. These are hydrides of radicals of the phenyl series. Being highly carbonaceous they emit great light, as is seen by passing H through benzole." It is therefore evident that we do not owe our knowledge of the presence of benzol in coal-gas either to M. Berthelot or Dr. Dittmar. Neither has the latter furnished us with any additional proof of its presence, unless we are to consider as proofs such sentences as the following, quoted from his paper (Chemical News, vol. xxxvi., p. 145) :—"It is true there *is* room for a little benzol." "These results render it highly probable that the light value of a coal-gas depends far more on the proportion of benzol than on the proportion of olefines contained in it. This, however, has nothing to do with the question on hand." "After these experiences I *felt convinced* that, although coal-gas as it comes out of the retort *cannot help* containing a considerable proportion of benzol, only very little of this vapour will survive the subsequent processes of purification." "Wishing very much to determine the exact ratio in the gas between the benzol and the olefines, I tried very hard to find out a quantitative method for their separation from each other, but I did not succeed." "The last substance I tried was non-vulcanised india-rubber, and if I may trust a few preliminary trials it *does seem* to have the power of abstracting the benzol from a gas without condensing *much* of the ethylene." If vague impressions and convictions like these are to be accepted as proofs then farewell to the reputation of chemistry as an exact science.

Lastly, Dr. Dittmar has given no quantitative determinations of the illuminating power either of benzol or of any other constituent of coal-gas, and I therefore fail to see that his paper anticipates, in any way whatever, the quantitative results communicated to the Chemical Society by Mr. Thorne and myself.—I am, &c.,

E. Frankland.

Royal College of Chemistry,
South Kensington Museum, Feb. 11, 1878.

* *Memoirs of the Lit. and Phil. Soc. of Manchester*, vol. ix., (2nd series) p. 265.

ON THE MOTIONS OF CAMPHOR ON THE SURFACE OF WATER.

To the Editor of the Chemical News.

Sir,—By some means I overlooked Mr. Casamajor's letter in the Chemical News, vol. xxxvi., p. 285, until last week, or I should have noticed it earlier.

I am sorry to have to dissent from nearly every one of Mr. Casamajor's statements, and especially from the statement implied in the following question :—"Does it really matter whether one person or twenty persons have written that these motions are not due to electricity, and whether the idea that they are 'has been more than once taken up and abandoned?'"

If it were usual in science to ignore the results and opinions of our predecessors (of Volta and of Faraday, for example, in electricity), science would soon come to a standstill, and every question of human interest would have to be discussed again *ab ovo*.

Naphthalene *does* rotate on the surface of water; but being insoluble in cold water and only slightly soluble in hot, the water must be raised to 90° or 100° F., and then the fragments rotate briskly enough.

There is no state or condition of weather which prevents the gyration of the camphor fragments. If the water and

* C=6.

the vessel be chemically clean the camphor always rotates on the surface of water; most briskly, however, in fine clear weather, when the evaporative force is strong. In reviving the electrical theory in order to explain a few facts, and neglecting the surface-tension theory which embraces all the facts, numerous and diversified as they are, seems to me to be unphilosophical.

I referred Mr. Casamajor's two letters contained in the Chemical News, vol. xxxvi., pp. 191, 285, to Professor Van der Mensbrugghe, the author of the surface-tension theory, of the camphor motions, &c., and the following is the substance of his reply:—

A glass rod acts quite differently from a stick of resin. A glass rod or tube, whether electrified or not, arrests the motions of the camphor, because, when plunged into the water, the fragments near it are repelled all round; whereas a stick of resin will often produce an effect of attraction, and renew the surface in proportion as it is plunged deeper.

Van der Mensbrugghe has established this principle: that every contracting liquid surface heats and diminishes in tension, while every expanding liquid surface cools and increases in tension. Hence, if we plunge into water on which the camphor fragments are moving a clean rod of any material capable of being wetted, the capillary curve formed round it repels the fragments, and the layers, more or less saturated with camphor, become crowded together, whereby the differences in tension around the fragments are got rid of, or at least become insufficient for the continuation of the motions. On the other hand, if we plunge into the water a stick of sealing-wax or of a body that is not wetted, a depression is formed, and hence a renewal of the surface round each fragment, and consequently a greater or less tendency to motion, supposing the fragments to be already at rest.

It may be added that if the gyrations are stopped by the plunging in of a body that is wetted, they become, on the other hand, more rapid by withdrawing it, because the surface is thereby renewed by the impulse given to the fragments, and the more so in proportion as the wetted solid had been plunged deeper. In general, every process which augments or renews the surface increases the tension; and inversely, whatever leads to a diminution or heaping up of surface, diminishes the tension.

I trust that, after studying the foregoing details, Mr. Casamajor will alter, if not his opinion, at least his mode of speech, which is not altogether in the spirit of scientific chivalry.—I am, &c.,

C. Tomlinson.

Highgate, N., February 11, 1878,

FEES.

To the Editor of the Chemical News.

Sir,—Mr. George Whewell, in last week's issue of your journal, referring to an analytical department recently instituted in connection with a trade journal (similar to those in connection with certain Continental publications), complains that a chemist should "do the work for less than half the usual fees." It will perhaps be sufficient to point out that no such statement is made in the article which your correspondent quotes from the *Textile Manufacturer*. The offer there made is from the proprietors of the journal to its subscribers, and has no connection with the arrangement between the journal and the chemist who does the work, although an ambiguity of language has caused Mr. Whewell to take it in the latter sense. There is nothing in the words quoted by Mr. Whewell to prevent the chemist getting *double the usual fees*, and the difference made between subscribers and non-subscribers ought, I think, to have prevented misconception on Mr. Whewell's part. As a matter of fact, the chemist in question knew nothing of the arrangement which your correspondent complains of until he saw it in type. On the general question of chemists' fees I may say that I think the present state of things unsatisfactory in many respects besides those touched on by Mr. Whewell, and I entirely agree with him in hoping the Institute of Chemistry will be able to place the matter on a basis more acceptable to professional chemists and to the general public.—I am, &c.,

The Chemist referred to.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 1, January 7, 1878.

On Persulphuric Acid, a New Oxy-Acid of Sulphur.—M. Berthelot.—The author has obtained a new oxy-acid of sulphur, the persulphuric, corresponding in composition to the permanganic and perchromic acids, and whose existence is conformable to the analogies drawn from a comparative study of the sulphates, the chromates, and the manganates. It may be obtained in the pure anhydrous state by causing the electric effluve, at high tension, to act upon a mixture of sulphurous acid and oxygen, in equal volumes and absolutely dry. Concentrated sulphuric acid, under the same conditions, combines neither with oxygen nor with ozone. Persulphuric acid takes its rise also, though in a state of solution, during the electrolysis of concentrated solutions of sulphuric acid, under which conditions it has been hitherto confounded, either with oxygenated water or with that imaginary substance which has been called antozone. The same compound is also formed, but in a dissolved state, if a solution of oxygenated water is cautiously mixed with sulphuric acid, either concentrated or diluted with a quantity of water less than 1 equivalent. But combination does not ensue when the sulphuric acid is previously mixed with 2 equivalents of water, or more. In all these cases a part of the oxygenated water remains. It is probable that persulphuric acid is produced also in various other circumstances, as when concentrated sulphuric acid acts at a low temperature upon alkaline or metallic peroxides and other oxidising agents. Persulphuric acid is prepared with the author's concentric tube-apparatus described in the *Annales de Chimie et de Physique* (5e Série, xii., p. 463). After boiling for eight to ten hours the surfaces of the annular space are covered with little drops of a thick and adhesive liquid. Sometimes this liquid even spreads over the surface of the glass in a thin iridescent layer. When exposed to a temperature near 0° C. it forms sometimes indistinct granular crystals; sometimes in slender, flexible, transparent needles, several centimetres in length. In its general appearance it resembles anhydrous sulphuric acid, but the latter may be distinguished by its opacity, and by forming much finer, shorter, and less lamellar crystals. Persulphuric acid possesses a considerable vapour tension, which, at the temperature of 10°, rises to several centimetres. It is also displaced readily by spontaneous sublimation in the tubes which contain it. It often, however, remains liquid, or forms merely confused crystals. Nevertheless its analytical composition remains the same, not being sensibly affected by the accidental presence of some traces of water, of nitric or nitro-sulphuric acid derived from nitrogen, or of saline compounds due to action on the glass, which, however, suffice to hinder or modify the crystallisation. These impurities increase with the alterability of the glass and with the proportion of nitrogen, conditions against which it is necessary to guard. The composition of persulphuric acid may be established either

synthetically or analytically. When the reaction is concluded we may extract the residual gas with the mercurial pump, measure and analyse it, and compare its volume to that of the original mixture. The volume of the residue should be one-eighth that of the original gaseous mixture. Four volumes of sulphurous acid combine with three volumes of oxygen to form persulphuric acid. The compound may be analysed by opening one of the lateral points of the tube over a titrated solution of stannous chloride. The latter is immediately aspired by reason of the decrease of internal pressure due to the combination of the two gases; it is partially oxidised, and its loss of strength—estimated by means of pure permanganate of potassa—gives the weight of oxygen absorbed. The sulphuric acid in the liquid is then determined as sulphate of baryta. In two specimens the excess of oxygen was found respectively 8·23 and 10·00, the sulphuric acid being 83·4 and 94·1. The composition is S_2O_7, with which a number of analyses, performed in various manners, agree. Persulphuric acid may be preserved for several days at a temperature bordering on 0°, but in about a fortnight it shows signs of spontaneous decomposition. The aqueous solution is destroyed rapidly. The solution in sulphuric acid, though more stable, gradually gives off oxygen, and at the end of six weeks is completely destroyed. Persulphuric acid heated over a flame is at once decomposed into oxygen and anhydrous sulphuric acid. In presence of air it gives off dense fumes, and is converted into hydrated sulphuric acid at the expense of the aqueous vapour in the atmosphere. It dissolves in concentrated sulphuric acid without loss of oxygen, and the solution may be then diluted with water without immediate decomposition. Even after the lapse of twenty-four hours the strength of such a solution is not found to have been sensibly changed. If platinum sponge is added to the sulphuric solution, whether concentrated or dilute, gaseous oxygen is at once evolved, especially if heat is applied. Persulphuric acid converts sulphurous acid into sulphuric acid; but if it has been previously dissolved in a large quantity of concentrated sulphuric acid, it yields with sulphurous acid a notable proportion of hyposulphuric acid. Persulphuric acid dissolves in water with effervescence, due to the escape of oxygen, and gives off dense fumes. A portion, however, from one-fourth to one-fifth, remains for some time undecomposed in solution. With baryta-water a part of the oxygen escapes at once, whilst sulphate of baryta is precipitated, another part of the acid forming barytic persulphate—a soluble salt, which is rapidly decomposed into oxygen and barytic sulphate. Persulphuric acid, in the cold, oxidises neither acid solutions of arsenious acid nor those of oxalic acid, in which respect it resembles oxygenated water. From this compound it is distinguished by the fact that it neither forms perchromic acid nor reduces potassic permanganate. It can co-exist in solution either with oxygenated water or with ozone. Sulphur forms with oxygen a series of definite compounds, increasing in the following proportions:—

S_2 : O (unknown; analogous to Cu_2O).
,, O_2 (hyposulphurous acid).
,, O_3 (unknown; analogous to Mn_2O_3).
,, O_4 (sulphurous acid).
,, O_5 (hyposulphuric acid).
,, O_6 (sulphuric acid).
,, O_7 (persulphuric acid).
,, O_8 (unknown: analogous to Os_2O_8).

This series expresses all the possible molecular types of the simple compounds which oxygen forms with other elements. The extreme limit, in most of the known cases, is reached by the acids which contain 7 equivalents of oxygen, such as the perchloric, permanganic, &c. These super-oxygenated acids offer a remarkable analogy in their physical and chemical properties, amounting in some cases to isomorphism. They constitute a true chemical type, RO_7, in which 7 equivalents of oxygen are associated with the most various elements. It is worthy of remark that the properties of the type are derived from the oxygen, and not from the oxidised element. They exist in the combination itself, and not in either of its constituent elements taken singly. The author is pursuing the study of the super-oxygenated acids of other elements.

On Certain Novel Modifications of the Telephone—M. Breguet.—A small plate of sheet-iron, quite analogous to that of Bell's telephone, is placed in contact with the end of an ordinary black-lead pencil, which presses gently upon the central part of the plate. The pencil and the plate are each connected by wires to the two ends of the wire of the coil of a Bell's telephone, the magnetised rod of which is replaced by a rod of soft iron. A battery of ten Leclanché elements is interposed in the circuit. When, on speaking, the plate of the apparatus is set in vibration, the end of the lead-pencil undergoes a series of modifications in its contact with the plate, but without contact being ever actually broken. These modifications show themselves as variations in the resistance of the circuit at the point of contact itself, and consequently by variations in the intensity of the permanent current of the battery. The current accordingly produces alternations of attraction and non-attraction in the electro-magnet of the receiving-apparatus, which act in the ordinary manner of Bell's apparatus.

Density of Liquid Oxygen.—R. Pictet.—M. Dumas appears to have found by calculation that the density of liquid oxygen, liquid or solid, should be equal to that of water. M. R. Pictet arrives at the same result experimentally. By the action of polarised light upon a jet of liquefied oxygen, solid particles were observed, probably minute crystals of oxygen.

Researches on the Intra-cellular Alcoholic Fermentation of Vegetables.—A. Muntz.—The author has experimented upon entire plants placed in an atmosphere of nitrogen. Very appreciable quantities of alcohol were detected, whilst similar plants kept as a check in ordinary air showed not a trace.

On the Inversion and the Alcoholic Fermentation of Sugar caused by Mould.—U. Gayon.—Not all moulds are capable of inverting sugar. *Penicillium glaucum* and *Sterigmatocystis nigra* rapidly produce this effect, whilst *Mucor mucedo*, *M. circinelloides*, *M. spinosus*, and *Rhizopus nigricans* are perfectly inert.

MISCELLANEOUS.

The Chemical Society's Research Fund.—We gave last week a list of the grants just made from the Research Fund of the Chemical Society. We are glad to state that since making these grants the fund has been increased by the following donations and subscriptions received from the Alkali Manufacturers' Association. The donations, amounting to £229, are from:—

Charles Tennant and Co.	£45
J. and L. Pattinson and Co.	35
R. Bealey and Co...	15
Roberts, Dale, and Co...	5
James Muspratt and Sons	35
A. G. Kurtz	50
Henry Baxter..	25
C. J. Schofield	5
Thomas Walker	9
D. McKechnie	5

The following are the annual subscriptions, to be continued for five years:—

Gaskell, Deacon, and Co.	£11	14
Chance Brothers	4	0
The Netham Chemical Co.	4	0
W. Pilkington and Son	7	0
James McBryde and Co.	3	0
W. Gossage and Son	4	10
Watson, Kipling, and Co.	2	18

Amounting altogether to £37 2s.

THE CHEMICAL NEWS.

Vol. XXXVII. No. 952.

ON DYER'S CHEMICALS.

By J. MARZELL.

(Continued from p. 56.)

Diphenylamin, $(C_6H_5)_2=NH$.

This base can be produced—(1.) By dry distillation of rosaniline and its phenyl derivatives, of leucaniline, and of melaniline.* (2.) By heating aniline with one of its salts to 220° to 250° C.†

$$C_6H_5NH_2+C_6H_5NH_2,S'=(C_6H_5)_2NH+NH_3S'.$$

Naturally, only the latter method could be used from an industrial point of view, and already in 1866 Ch. Girard and De Laire,‡ took patents in this direction for manufacturing that body on a large scale. The proportions for mixing aniline with its hydrochlorate vary. In the patent they take by preference 3 parts of aniline to 1 part of its hydrochlorate, for the reason that a surplus of aniline facilitates the reaction. In practice,‖ a charge-adjusted to an apparatus of a certain size consists of 140 lbs. of hydrochlorate and 100 lbs. of aniline.

The apparatus for this has a capacity of about 5600 c.″= about 16″ of D., and 27″ of H., capable of holding about 20 gallons. The vessel is of cast-iron, and proved for a high pressure. It is set in brickwork, having a fireplace beneath, but an arrangement is made, that the flame cannot play directly on the vessel. The apparatus is enamelled inside. The enamel is either laid on the body itself or a separate thin cast-iron and enamelled vessel—adjusted to the inner form of the pressure-tube—is inserted, the tight joining being effected by filling up the space between with melted lead. That arrangement is better in this way, that, if the enamel gets damaged, by replacing this vessel by a new one kept in reserve, the damage can be repaired without causing any delay or interruption of work. The cover of the pressure-pot is fastened by bolts and screws, and, besides a pressure-gauge and safety-valve, it is provided with a kind of man-hole, allowing the apparatus to be charged without taking off the cover. In choosing the pressure-gauge it must be remembered that it has to stand a high heat. The safety-valve is regulated in a way that it blows off at a pressure of 5 to 6 atmospheres (75 to 90 lbs.).

The action takes place in the following manner:—

$$\left.\begin{matrix}C_6H_5\\H\\H\end{matrix}\right\}N+\left.\begin{matrix}C_6H_5\\H\\H\end{matrix}\right\}N,HCl=\left.\begin{matrix}C_6H_5\\C_6H_5\\H\end{matrix}\right\}N+NH_4Cl.$$

After putting in the mixture—filling up the vessel to about two-thirds of its volume—the man-hole is closed, and fire applied. It is heated up till the safety-valve just begins to blow off, and the temperature—now about 265° to 280° C. inside the pot—is maintained for about twelve hours. A steady regular temperature is of much advantage for the reaction and yield.

A very disagreeable point in this process is a secondary reaction, taking place during the operation, and spoiling the yield considerably. The ammonia liberated in the reaction acts upon the formed diphenylamin in the following manner, reducing it to aniline:—

$$\underbrace{\left.\begin{matrix}C_6H_5\\C_6H_5\\H\end{matrix}\right\}N}_{\text{Diphenylamin.}}+\underbrace{NH_3}_{\text{Ammonia.}}=2N\underbrace{\left\{\begin{matrix}C_6H_5\\H\\H\end{matrix}\right.}_{\text{Aniline.}}$$

The only precaution against it is to let out the formed NH_3 from time to time by lifting the safety-valve or opening a cock especially added to the apparatus for this purpose. Though a small quantity of aniline vapours escape with the ammonia, in a well directed operation the loss is so very inconsiderable that it is not worth while to complicate the apparatus by the application of a condenser.

Girard and De Laire* give a sketch of an apparatus connected with a refrigerator and a condenser. They at first heat up for about two hours with the cock of the refrigerator opened, till the temperature has risen to about 215° to 220° C. Then the cock is shut, and the reaction finished under pressure, the ammonia and aniline being gathered in the condenser. The yield is said to be in this case 50 to 70 per cent of the aniline used.

It is to be remarked that pressure is not an indispensable condition, and that diphenylamin can be got as well by heating the mixture at common air-pressure for some time to the boiling-point. But as in this way the operation requires much more time, and the yield is not nearly so satisfactory as in the first case, this method could not be adopted in industry.

If the operation is finished the apparatus is allowed to cool down, the safety-valve opened, and the cover taken off. The half-solid mass is taken out, brought into a wooden tank, and treated with about 140 lbs. concentrated hydrochloric acid. Heating up takes place (40° to 60°), and a solution is formed containing hydrochlorate of diphenylamin, hydrochlorate of aniline, and free hydrochloric acid. Whilst well stirred, and supplying a slight heat by means of direct steam if necessary, 60 to 80 galls. of water are added, and after intimately mixing the liquid is allowed to settle for at least twelve hours.

The hydrochlorate—like all salts of diphenylamin—being very unstable is decomposed into diphenylamin and free hydrochloric acid, whilst the hydrochlorate of aniline remains in solution in the acid liquor. The diphenylamin gathers on the surface, and solidifies in cooling. It is taken off and washed, at first with hot water, then with a slight alkaline solution, and finally with hot and cold water till it is completely neutral; afterwards it is pressed and dried, best at common temperatures. According to the low fusing-point of the diphenylamin (54° C.) even a small heat, in the drying rooms, can be supplied only with great precaution. Good ventilation is the only thing to assist and to quicken the process.

The crude product obtained in this way is always coloured, and has to pass an operation of purifying. The usual way is to re-distil it. The stills are cast-iron vessels with a flat bottom, the cover fastened by screws. They are heated up by direct fire, and are set in brickwork like the pressure-tube described above.

The diphenylamin distils at 310° C., the temperature in the still varying between 310° and 350° C.

Another method—but causing more inconvenience without giving better results—is to extract the diphenylamin instead of washing the impurities out, and to separate it from the non-diluted bodies by filtering. As solvent, either benzol or petroleum (the best distilling between 80° and 150° C.) are taken. In evaporating them off, the diphenylamin remains as the residue; it is pressed and distilled.

A method, perhaps to be used with great advantage, is the sublimation with superheated steam. Only a heating up to the fusing-point is wanted in this way, and therefore a smaller loss from carbonisation to be foreseen than at a temperature up to 350° C.

The diphenylamin obtained in this way represents a

* A. W. Hofmann, *Ann. Chem. Pharm.*, cxxxii., p. 100.
† Girard, De Laire, and Chapoteaut, *Comptes Rendus*, lxiii., p. 91.
‡ English Patent, No. 1093.
‖ Girard and De Laire, Derivés de l'Houille, Paris

* Derivés de l'Houille.

yellowish white body of an agreeable aromatic smell. The chemically pure body crystallises in white needles. It is nearly insoluble in water. Alcohol, ether, benzol, petroleum, and aniline dissolve it in great quantities. With the mineral acids and acetic acid it forms salts, which are decomposed on addition of water. In this case the diphenylamin separates in yellow oily drops, solidifying on cooling.

ANALYSIS OF CANE-SUGAR ASH.

By Dr. WALLACE, Glasgow.

The following analysis of the ash of cane-sugar may be interesting to those engaged in the manufacture or refining of sugar. The sugar contained an unusually large proportion of ash (1·38 per cent), and I understand that the canes from which it was made were grown near the sea coast in Demerara, or the adjacent Dutch colony. So far as I can ascertain the cane-juice was treated with lime only.

Potash	29·10
Soda	1·94
Lime	15·10
Magnesia	3·76
Sulphuric anhydride	23·75
Phosphoric ,,	5·59
Carbonic ,,	4·06
Chlorine	4·15
Peroxide of iron	0·55
Alumina	0·65
Silica	12·38
	101·03
Deduct O=Cl	0·93
	100·10

THE FORMATION OF CRYSTALS OF CALCIUM OXALATE IN THE URINE AFTER ITS DISCHARGE.

Communicated by Prof. ALBERT B. PRESCOTT.

The importance attributed by medical authorities to the occurrence in the urine of calcium oxalate in crystals, irrespective of the time or conditions transpiring between the discharge of the urine and its examination, led to some investigation in the chemical laboratory of this institution as to the effect of time in production of these crystals. All the examinations here reported upon were made by M. E. Post.

The samples of urine were taken both from persons in health and from the sick. In every case *the urine of twenty-four hours* was taken together, and examined, soon after the last portion of it was passed, for all deviations from the normal standard, the specific gravity being taken and a careful search made for crystals of calcium oxalate. Specimens containing the crystals in question at this first examination were rejected; all other specimens were set aside at ordinary temperature (in May and June), the twenty-four hours' urine standing in one bottle, and being examined each day thereafter for the oxalate, until oxalate crystals appeared or the experiment was abandoned with a negative result for the time stated. The results for forty-four specimens *not showing oxalate at first examination* are given below. The specific gravity was taken by weighing in about half the cases; Vogel's urinometer being used for the others. It will be seen that in about 68 per cent of the cases, crystals of oxalate were formed after the first examination, the average period of appearance of the oxalate being at 5th day.

No.	Sp. Gr.	Principal Deviations.	Appearance of Oxalate
1	1·028	Urates precipitated	Appeared 7th day
2	1·012	Excess of phosphates	,, 5th ,,
3	1·014	Normal	,, 12th ,,
4	1·030	Urates crystallised	,, 6th ,,
5	1·019	Uric acid crystallised	,, 3rd ,,
6	1·018	Urates crystallised	,, 13th ,,
7	1·020	Excess of epithelium	,, 11th ,,
8	1·015	,, ,, ,,	None to 20th ,,
9	1·023	Sugar	Appeared 4th ,,
10	1·023	Epithelium, urethra	None to 30th ,,
11	1·015	Epithelium, pus, blood, casts, and albumen	,, 28th ,,
12	1·018	Pus, tubular casts	,, 28th ,,
13	1·031	Urates visible	Appeared 2nd ,,
14	1·030	,, ,,	,, 2nd ,,
15	1·024	Normal	,, 2nd ,,
16	1·019	,,	,, 2nd ,,
17	1·023	Excess of urea	,, 3rd ,,
18	1·016	Normal	,, 4th ,,
19	1·029	Urates crystallised	,, 26th ,,
20	1·022	Normal	,, 3rd ,,
21	1·029	,,	None to 22nd ,,
22	1·016	Uroxanthine	,, 22nd ,,
23	1·017	Normal	Appeared 3rd ,,
24	1·032	,,	,, 2nd ,,
25	1·032	,,	None to 18th ,,
26	1·012	Excess of epithelium	Appeared 3rd ,,
27	1·010	Deficiency of urea	,, 2nd ,,
28	1·022	Normal	,, 2nd ,,
29	1·026	,,	None to 24th ,,
30	1·022	,,	,, 24th ,,
31	1·019	,,	Appeared 4th ,,
32	1·019	,,	None to 24th ,,
33	1·025	,,	Appeared 4th ,,
34	1·020	,,	None to 18th ,,
35	1·017	Excess of epithelium	Appeared 2nd ,,
36	1·021	Normal	,, 3rd ,,
37	1·025	,,	,, 3rd ,,
38	1·027	Excess of epithelium	,, 5th ,,
39	1·025	Normal	,, 2nd ,,
40	—	,,	,, 3rd ,,
41	1·030	Uric acid, crystallised	,, 6th ,,
42	1·024	Normal	None to 25th ,,
43	1·024	,,	,, 22nd ,,
44	—	,,	,, 12th ,,

After the day when the crystals of oxalate appeared there was little apparent change in the number and size of the crystals until the urine became alkaline, when they began to diminish, and, in the three cases which were daily examined, the crystals of oxalate after a few days of alkalinity wholly disappeared.

A few determinations of *the quantity of uric acid* were made before and after the appearance of oxalates, but the experiments were too few to be of much value. Of seven trials only four samples showed oxalate crystals on standing; of these, three gave less uric acid after the appearance of the oxalate than before, and one gave the reverse of these results. The uric acid was determined by its crystallisation, and the estimation of the crystals, washed with 5 c.c. of alcohol, by standard solution of permanganate. The quantities were as follows:—

	Urine.	Before Oxalates Appear.	After Oxalates Appear.
1	812 c.c.	0·1218 grm. uric acid	0·0324 grm. uric acid
2	600 ,,	0·2568 ,, ,,	0·1620 ,, ,,
3	815 ,,	0·0880 ,, ,,	0·1597 ,, ,,
4	530 ,,	0·6148 ,, ,,	0·3086 ,, ,,

It is designed hereafter to investigate the effect of temperature upon the production of calcium oxalate crystals; also, to experiment with quantitative methods for the oxalate to be applied before and after appearance of the crystals.

University of Michigan,
November 14, 1877.

THE APPLICATION OF AMMONIUM SULPHOCYANIDE IN VOLUMETRIC ANALYSIS.

By J. VOLHARD.

Determination of Silver.

In a nitric solution of silver to which a soluble ferric salt has been added a permanent redness does not appear on the gradual addition of a dilute solution of ammonium or potassium sulphocyanide until all the silver has been thrown down as a sulphocyanide. If we know how much of the sulphocyanide solution is required to precipitate a known weight of silver we can determine volumetrically the quantity of silver present in any acid argentic solution, the ferric salt serving as an indicator. For the preparation of the standard solution the author uses ammonium sulphocyanide, though Lindemann prefers the potassium salt; both, in dilute solution, are permanent. But the ammonium salt is less frequently contaminated with chlorides, which interfere greatly if present in more than mere traces. The solution may be conveniently made of such a strength that 1 c.c. indicates 1 centigrm. of silver. The weighed quantity of the salt is dissolved in water, and diluted in a graduated flask so far that 7·5 grms. (or 8 grms. if the salt appears very damp) may be contained in each litre. For the precipitation of 1 grm. of silver 0·704 grm. of pure ammonium sulphocyanide is requisite; 0·5 grm. of chemically pure silver is then weighed out, dissolved in 8 to 10 c.c. of pure nitric acid of sp. gr. 1·20, and, after the complete solution of the metal, the nitrous acid is expelled by boiling or prolonged heating on the sand-bath, and the solution is allowed to cool. It is then diluted with 200 c.c. of water, and 5 c.c. of a cold saturated solution of ammonia-iron alum are added. If the colour of the ferric salt is perceptible a little pure colourless nitric acid is added till it disappears. The sulphocyanide solution is then added from a burette. At first a white precipitate is produced which remains suspended in the liquid like silver chloride, rendering it milky. On the further addition of sulphocyanide each drop produces a blood-red cloud, which quickly disappears on agitation. As the point of saturation is reached the silver sulphocyanide collects in flocks, and the liquid grows clearer without becoming perfectly limpid as long as a trace of silver remains in solution. As soon as all the silver is precipitated the flocculent precipitate quickly deposits and the supernatant liquid becomes quite clear. The sulphocyanide solution is added by drops till this point is attained, and till a very faint light brown colour appears in the liquid, which does not vanish on repeated agitation. The colour is most easily perceived if the liquid is held, not up to the light, but against a white wall turned away from the window.

For a repetition of the experiment it is convenient to use a silver solution of known strength. For this purpose 10 grms. of pure silver are dissolved in nitric acid in a litre flask, the nitrous acid is expelled, the liquid is allowed to cool, and diluted up to the volume. For use 50 c.c. are taken with a pipette. If the above-mentioned proportions are preserved for 0·5 grm. silver or 50 c.c. of the silver solution, somewhat less than 50 c.c. of the sulphocyanide solution will be required, whence the needful dilution can be calculated. If 48·5 c.c. sulphocyanide have been used, then to every 48·5 c.c. of the solution 15 c.c. of water must be added.

The solution is perfectly permanent, even on being kept for two years. The silver solution must have a decidedly acid reaction from free nitric acid, which it is quite unnecessary to neutralise. Nor is it important that the proportion of acid in different experiments should be approximately equal. It is, however, essential for the constancy of the results that the ferric salt should be in large excess, and should be used approximately in one and the same proportion to the total volume of the fluid. It must also be remembered that the colour of ferric sulphocyanide is destroyed by nitrous acid at common temperatures, and by nitric acid on the application of heat. Hence follows the necessity of completely expelling all nitrous acid, and of allowing the liquid to become cold before the operation is begun. The nitric acid used in this process should be kept in the dark.

Titration of Silver in Presence of Other Metals.

Copper.—The proportion of copper in an alloy may reach 70 per cent without in the least affecting the accuracy of the process. Beyond this limit the recognition of the final reaction is somewhat doubtful, since after the precipitation of the silver the liquid is rendered opaque and discoloured by the formation of black copper sulphocyanide. The only remedy in such cases is to add a known weight of pure silver to the alloy so as to reduce the proportion of copper below 70 per cent, as is done in Gay-Lussac's process.

Mercury.—In presence of this metal silver cannot be titrated with sulphocyanide solution. This defect is of little consequence as mercury is readily expelled.

Palladium renders the titration of silver with a sulphocyanide inaccurate, this metal appearing in the result as silver. This is an important circumstance from a technical point of view, since palladium, though frequently present in silver, occurs in very small quantities.

As regards other metals soluble in nitric acid and found along with silver in alloys and ores, lead, cadmium, thallium, bismuth, zinc, iron, and manganese are without influence. The recognition of the final reaction in solutions strongly coloured by salts of cobalt or nickel requires some practice. At first a few drops of sulphocyanide will always be added in excess. It is then recommended to titrate back with a solution of silver, when the pure colour of the cobalt or nickel will appear so suddenly and distinctly, that it will conversely be easy to seize the exact point when the colour of the solution is modified to a yellowish brown by the addition of the colour of ferric sulphocyanide. When this change of shade has been observed four or five times by titrating backwards and forwards with exactly corresponding solutions of silver and of sulphocyanide such a certainty in the recognition of the final reaction will be attained that there can be no doubt as to the addition of a half drop more or less.

The presence of tin, antimony, and arsenic does not interfere with the accuracy of the process.

A comparison of the results of this method as compared with those obtained by cupellation and by Gay-Lussac's method shows that it is not inferior in accuracy. In comparison with Gay-Lussac's process it has the advantage that the preliminary cupellation is dispensed with, and the end of the reaction is more distinctly recognised.

Determination of the Halogens.

For these determinations two standard solutions are required, one of silver and one of sulphocyanide. For the former 10·8 grms. of chemically pure silver are dissolved in pure nitric acid (sp. gr. 1·20) in a litre flask, and after the expulsion of nitrous acid made up to 1000 c.c. A solution of ammonium sulphocyanide prepared as above-directed is adapted to this silver solution, so that when equal volumes of both are mixed in presence of a ferric salt there may appear a colouration just perceptible. Both solutions are of course decinormal.

The determination of chlorine is conducted as follows:—The weighed sample of chloride is dissolved in 200 or 300 c.c. of water, mixed with 5 c.c. of the ferric solution, and so much nitric acid as may cause the colour of the ferric salt to disappear. A measured quantity of silver solution, rather more than necessary to precipitate all the chlorine, is then added, and without filtering off the silver chloride the sulphocyanide is then dropped in with the burette, taking care to ensure the immediate mixture of the drops with the fluid by constant agitation. As soon as the solution takes a pale yellowish brown colour, which after agitation remains permanent for ten minutes, all the silver is precipitated, and the liquid contains no per

ceptible trace of chlorine in solution. The number of the c.c. of silver solution added less the number of c.c. of sulphocyanide solution consumed multiplied by 0·00355 gives the weight of the chlorine in grammes.

If the amount of the chlorides is totally unknown so that we do not know approximately how much silver solution is to be added, the sample is mixed with ferric solution and nitric acid as before, and whilst the silver solution is gradually run in from the burette a drop of sulphocyanide solution is added from time to time. As long as there is still chlorine in solution the redness produced disappears but slowly and gradually, but as soon as the colour produced by a new drop of sulphocyanide disappears immediately on agitation, and the liquid appears of a pure milk-white, enough silver has been added, and the titration is completed as directed above. Of course the quantity of sulphocyanide added at first or during the introduction of the silver must also be deducted from the silver solution. It is therefore well to drop in the sulphocyanide with the same burette which is used for the completion of the titration.

Bromine.—The dilute solution of the bromide is mixed with 5 c.c. of iron solution and a little nitric acid, and strongly coloured with a few drops of sulphocyanide solution. The silver solution is then added from a burette till complete decolouration is produced, and the titration is completed with sulphocyanide, which is added till the liquid takes a faint but permanent pale brown colouration. The number of c.c. of silver solution added less the number of c.c. of the sulphocyanide solution consumed, multiplied by 0·0080, gives the weight of the bromine present in grammes.

Iodine.—The iodine is dissolved in 200 or 300 parts of water, preferably in a glass with a well-fitting stopper, and the decinormal solution of silver is added from a burette. As long as iodine remains in solution, the silver iodide remains in a state of milky suspension, and even persistent agitation does not clear the solution. When, by the gradual addition of the silver solution, all the iodine has been thrown down the precipitate becomes collected in flocks, and as soon as a minimum excess of silver is present the liquid appears to coagulate, and on shaking the flocculent silver iodide separates from the limpid liquid. By this phenomenon the conclusion of the reaction is indicated. From one-tenth to two-tenths of a c.c. of the silver solution must then be superadded, the flask stoppered, and shaken for some minutes. In this manner any soluble iodide which has been entangled in the precipitate is converted into silver iodide. Iron solution to the extent of 5 c.c. is then added along with a little nitric acid, and sulphocyanide solution is added with the burette till the liquid is very distinctly coloured. On shaking this colour disappears. Small quantities of sulphocyanide are then added with alternate agitation, till a slight but permanent colour is obtained. The number of c.c. of silver solution consumed less that of c.c. of sulphocyanide used and multiplied by 0·0127, gives the weight of the iodine in grammes.

Determination of the Halogens in Organic Compounds.

When the organic matter is previously destroyed by ignition with lime, or, preferably, with carbonate of soda and saltpetre, the application of the volumetric process is too simple to require a special description.

Recognition and Determination of the Halogens in Presence of Sulphocyanides.

Silver suiphocyanide is destroyed by heating with concentrated sulphuric acid, and is readily dissolved by the addition of a little nitric acid. If the sulphuric acid is diluted with half its bulk of water it does not attack silver chloride, whilst its action upon silver sulphocyanide is scarcely lessened. If it is therefore required simply to detect or determine chlorine in presence of sulphocyanides, the solution of the latter, acidified with nitric acid, is precipitated with excess of silver solution. The precipitate filtered and drained is placed along with the filter in a boiling flask and covered with pure sulphuric acid of the strength above-mentioned. If, on heating, it becomes black and clotty a few drops of nitric acid are carefully added. The silver chloride if present in quantity remains substantially undissolved; if but little chlorine was present complete solution may ensue, but on dilution with water silver chloride is deposited, free from silver sulphocyanide.

In order to detect and determine bromine or iodine in presence of sulphocyanides, the latter are destroyed by fusion with saltpetre and sodium carbonate. It must be remembered that the reaction is extremely violent, and that unless a large proportion of the carbonate is used deflagration may ensue. It is preferable to introduce the mixture gradually into the ignited crucible. The sulphocyanide is mixed with 10 to 15 parts of dry sodium carbonate, and the mixture, having been dried by gently heating in a porcelain crucible and pulverised afresh, is gradually added to 8 to 10 parts of melted saltpetre.

Separation of Silver Chloride and Iodide.

Silver chloride, when treated with ammonium sulphocyanide in an ammoniacal liquid, is readily and completely converted into silver sulphocyanide, while silver iodide remains untouched.

Cyanogen.—Silver cyanide is converted into sulphocyanide by hydrosulphocyanic acid so rapidly that dissolved silver cannot be titrated with sulphocyanide solution in presence of silver cyanide. But if the silver cyanide be precipitated from a given quantity of prussic acid by an excess of silver solution, there is no difficulty in titrating the excess of silver in the filter with sulphocyanide solution. For the determination of hydrocyanic acid, however, the author prefers Liebig's original process, using a centinormal silver solution. He points out that dilute solutions of hydrocyanic acid are much more volatile than had been supposed.

Determination of Copper.

Copper is precipitated as a sulphocyanide of constant composition in presence of powerful reducing agents, such as sulphurous acid. From the solution of a copper salt, not too acid and mixed with sulphurous acid, the copper is completely precipitated by ammonium sulphocyanide. A gentle heat promotes the formation and separation of the precipitate. The quantity of the copper is found by precipitating with a known excess of sulphocyanide solution, and then determining with silver solution, after addition of ferric salt and nitric acid, the quantity of sulphocyanide remaining in solution.

The standard solutions of silver and sulphocyanide are decinormal as used for the determination of the halogens. The sulphurous acid does not interfere with the distinctness of the final reaction if ferric salt has been added in sufficient quantity.

For the titration of mercurial compounds the process is less exact and is not recommended by the author.

The oxidising power and value of dilute permanganate solutions can also be determined by means of a solution of sulphocyanide titrated with silver.—*Liebig's Annalen der Chemie.*

Gallium.—At the *Académie des Sciences* on Monday last M. Lecoq de Boisbaudron exhibited a bar, a sheet, and several crystals of the new metal, *Gallium*, which is harder than iron, yet melts at under the heat of the finger, its freezing-point being at about 30°. It is proposed to use it for a thermometer going up to red-heat. 5000 kilogrms. of ore had to be worked down to get 60 grms. of metal. It will now be possible to investigate its physical properties. It adheres to glass, and is very brittle; the colour is nearly that of steel; and the crystals are octohedra.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

February 16, 1878.

Professor W. G. Adams, President, in the Chair.

The following candidate was elected a Member of the Society:—Mr. G. H. West, M.A.

Dr. Lodge read, for Mr. H. F. Morley, M.A., a paper "*On Grove's Gas Battery*." After referring to the views of M. Gaugain and Mr. Grove himself with regard to the cause of the action of this apparatus, the author proceeded to describe an elaborate series of experiments he has recently made in order to ascertain the circumstances by which it is regulated. It would be impossible to give a clear account of them in a short space, but some of his conclusions are as follows:—The whole of the current is due to dissolved gas, and if n be the distance of the level of the liquid from the top of the plate in the H tube, and

$$E = \frac{CR}{1000},$$

C being given in galvanometer readings, and R in ohms, he finds that, approximately, $(1+na)C = b+ne-(c+nd)E$, where a, b, c, d, and e are constants. The electromotive force is not constant, but rises with the resistance. The current is greater in proportion as the gas present in the elements is less; and, finally, the current appears to vary directly with the pressure.

Mr. S. C. Tisley then described the "*Harmonograph*," specially referring to its use for drawing pairs of curves for the stereoscope. This, the latest form of his pendulum apparatus, is capable of giving a very great variety of curves, for, in addition to rectangular vibrations, parallel and elliptic motions can be combined by its means. In the older form of apparatus each pendulum moves on the other as a centre, whereas in the instrument described they are independent. One pendulum carries at its upper end a table, which can be caused to rotate by clockwork if required. The whole is supported on a kind of gimbal joint formed of two pairs of knife-edges at right angles, so arranged that each vibration can take place either on one or the other, or the two can be so combined as to give a circular motion; or, again, the pendulum can be caused to vibrate in any given plane. The second pendulum vibrates in the plane in which the two hang, and carries at its upper end an arm terminating in a pencil over the table of the other pendulum. A very ingenious adjustment renders it possible to raise or lower the bob of the second-named pendulum during its motion. If two pens be attached, about 2½ inches apart, instead of the single one usually employed, and two curves be traced, they are not precisely similar, and when viewed in a stereoscope they are found to give the well known appearance of solidity to the figure. It was further shown that by gradually changing the relative motions of the pendulum it is possible to impart to the curve many of the forms observed in biaxial crystals in the polariscope.

Mr. F. J. M. Page then exhibited the action of the telephone on a capillary electrometer. The construction of Lippmann's electrometer, as modified by Marey, was first explained, and the meniscus of the mercury in the capillary tube was thrown on the screen by the electric light. The delicacy of the instrument was shown by passing a current of 1-1000th of a Daniell, which caused a distinct movement of the mercury. Resistances of 500 ohms and 1-50th ohm gave approximately the same deflection, so that, in practice, the instrument may be considered to be independent of resistance, in addition to which it possesses the great advantage of portabillty, and its indications are almost instantaneous. To illustrate the use of the electrometer for physiological investigations, a frog's heart was connected by non-polarisable electrodes with the instrument: each beat of the heart caused a considerable movement of the mercury column. A telephone was now connected. On pressing in the iron plate the mercury moved, and on reversing the wires the movement was seen to be in the opposite direction. On singing to the telephone each note produced a movement, but the fundamental note of the plate, as well as its octaves and fifths, had the greatest effect. On speaking, the mercury oscillated continually: some letters of the alphabet had scarcely any effect, and the *w* was especially curious, producing a double movement. Reversing the wires did not alter the character or *direction* of these movements. The same effect was observed when the telephone was in the primary and the electrometer in the secondary coil of a Du Bois Reymond's induction coil. In conclusion, Mr. Page showed the contractions produced in a frog's leg. On inserting nnder the sciatic nerve two platinum wires coupled with the binding-screws of a telephone, and talking to this instrument, violent contractions ensued.

In the course of the discussion which followed,

Prof. Graham Bell expressed himself as highly gratified at the results of Mr. Page's experiments. He has made very many attempts to ascertain the strength of the current produced by the human voice in vain, but considers the present method will in all probability give some most valuable results. He was quite unable to account for the fact that the motion of the mercury took place *from* the opening, but this seems to depend on conditions not yet determined.

Mr. Wilson then exhibited for Prof. S. P. Thompson a "*Lantern Slide Galvanometer*" for showing the deflections of the needle to an audience. It consists of a coil of insulated copper wire wound on a flat bobbin, within which a needle is balanced on a horizontal axis. This needle carries a long needle of aluminium, which traverses a semi-circular divided photographic scale, and as this is transparent the index can be projected on to the screen. The whole is enclosed between two glass plates.

CORRESPONDENCE.

AMMONIA IN FILTERED WATER.

To the Editor of the Chemical News.

Sir, Kindly permit a few words on your correspondents' remarks on the above subject (Chem. News, vol. xxxvii., pp. 9, 19, 30, 38). I think I may confidently assert that I never found in water, which had been filtered through spongy iron, anything like 7·30 parts of ammonia per million, when the unfiltered water was free from it. Did the filter to which your correspondent refers have fair play? Filters are frequently placed close to ill-ventilated water-closets; there may be a leakage of gas near them, or they may be tampered with in various ways from ignorance or mischief. In one instance a complaint reached me that a filter did not work satisfactorily. By degrees I found out that this filter had been employed for clarifying turbid wine, and when, naturally, the water afterwards had a disagreeable taste, hydrochloric acid was poured into the spongy iron to cleanse the filter! After such experience chemists ought to be careful before drawing general conclusions from exceptional results.

There is little doubt that ammonia is formed in the filter by the combination of atmospheric nitrogen and of hydrogen, resulting from the decomposition of water by spongy iron, but I am satisfied that this is an extremely minute item. I have left distilled water in contact with spongy iron for three months, and even then it contained only 1·54 parts of ammonia per million. Moreover, if that source of ammonia were not so insignificant, how is it that the filtered water is not always so highly charged with ammonia. On the contrary, hy referring to Tables

(p. 220) of the "Sixth Report of the Rivers Pollution Commission," you will find that the filtered water is not unfrequently quite free from ammonia. In my opinion the latter is mainly derived from the decomposition of nitrates and of nitrogenous organic matter.

It was, I suppose, a slip of the pen if one of your correspondents asserted that water filtered through spongy iron, and natural waters from ferruginous strata were under the same influence. I cannot see how any one of the explanations of the formation of ammonia by spongy *metallic* iron would hold good in the case of such natural water.

Lastly, as to the significance of ammonia in water, chemists will, I think, agree that even such a quantity as 7·30 parts per million is in itself harmless. However, we look with suspicion upon a natural water containing any large quantity of ammonia, because the latter serves to a certain extent as an indicator of decomposing animal matter in the water: I say to a certain extent, because the indication thus afforded is very frequently misleading. Thus, in the Report above referred to, we find in the Table (p. 74) two shallow well-waters, one of which is free from ammonia, but contains 2·42 org. carbon, 1·15 org. nitrogen, and 31·02 nitrogen as nitrates and nitrites per million. The other sample, with 0·17 part of ammonia, shows only 0·38 of org. carbon, 0·07 of org. nitrogen, and 23·07 of nitrogen as nitrates and nitrites per million. However this may be, in the spongy iron filter the water passes solely through inorganic materials, which cannot in themselves contain the elements of organic contamination. The presence of ammonia in the filtered water *must* therefore be due to some such reaction as herein mentioned, and thus evidently loses any significance which we may attribute to it when dealing with a natural water.—I am, &c.,

Gustav Bischof.

Analytical Laboratory, 4, Hart St., Bloomsbury, London, W.C., February 11, 1878.

ESTIMATION OF PHOSPHORUS IN IRON AND STEEL.

To the Editor of the Chemical News.

Sir,—I am afraid, from the report which has appeared, that my remarks (Chem. News, vol. xxxvii., p. 68) on Mr. Riley's paper at the Chemical Society were not perfectly understood. The long time (two or three days) required for the complete precipitation of Mr. Riley's magnesian phosphate is undoubtedly owing to the large amount of citrate of ammonium present; but this large proportion of citrate of ammonium is actually necessary, from the considerable amount of iron present, and cannot therefore be described as "too much."

When the solution of phosphoric acid contains no citrate, tartrate, or oxalate, precipitation by magnesia is complete in half an hour, according to the experiments of E. M. Dixon. Thus, though the molybdic method when properly carried out—by removal of chlorides and re-solution of the molybdic precipitate—is longer in its earlier stages than the citric acid method, it is far shorter in its later stages, and I should doubt if, on the whole, it would occupy more time.

Mr. Riley may be quite right in condemning the present use of the molybdic method by metallurgic analysts, but that the method when properly employed is most accurate does not at the present day admit of doubt.—I am, &c.,

R. Warington.

Harpenden, February 16, 1878.

THE INSTITUTE OF CHEMISTRY.

To the Editor of the Chemical News.

Sir,—The Report of the General Meeting of the Institute (Chem. News, vol. xxxvii., p. 57) furnishes the information for which I asked in my last letter.

From that Report we learn that of the first batch of "more than 300 chemists" elected as Fellows of this Institute, only 153 have as yet accepted the Fellowship; and that of the second batch of 160 Fellows and 43 Associates elected by the Council, only 65 have accepted their election. In other words, only about half of those chemists whom the Council elects have been prevailed upon to accept their election—which constitutes a preliminary *fiasco*.

Persons who, like myself, look upon the Institute with disfavour, will also be amused at the President's account of the difficulties which his Company encountered at the Board of Trade, and how—in order to get registered—the Institute submitted to the explicit abandonment of the power of granting "any certificate of proficiency or qualification."

How, after such abandonment, the Institute is to be regarded as standing in the same relation to the profession of Chemistry as that occupied by the Colleges of Surgeons and Physicians towards Medicine, passes my comprehension. Perhaps the four newly-elected Censors may explain this difficulty.—I am, &c.,

J. Alfred Wanklyn.

February 9, 1878.

COPPER EXTRACTION.

To the Editor of the Chemical News.

Sir,—Noticing Mr. Wilson's communication upon the above subject (Chem. News, vol. xxxvii., p. 65), I offer the following remarks upon it:—

1. The process is a very old one. G. D. Mease, in January, 1861 (No. of patent, 42), advocated the employment of waste manganese liquor. In July, 1861 (No. of patent, 1869), Edward Haeffely put forward a process substantially the same as described by Mr. Wilson on p. 65. He describes the process in his specification very minutely. He states that the burned ore is to be placed in vats, "the whole arrangement being similar to that commonly employed for lixiviating soda-ash." "The liquid employed is the residue from the manufacture of chlorine when muriatic acid and manganese have been used, generally thrown away as useless." The solution is to be diluted if necessary, and placed in a vat where "vat waste from the manufacture of soda-ash is added, so as to precipitate the whole of the copper as sulphuret," "which is collected on a sand- or other filter, washed with water," dried, and "converted into sulphate or otherwise disposed of, as may be desired." In March, 1866 (No. of patent, 753), W. F. Deane obtained provisional protection for the following:—"Treating the roasted pyrites with the residual liquor arising from the production of chlorine gas, and obtaining the copper in the form of sulphuret," "which last result is oxidised, and brought into the form of sulphate of copper."

2. There are so few places now where the chloride of manganese solution can be called a waste liquor, and even these few must gradually die out.

3. That even could this still liquor be obtained, used as it would be for the free acid it contains, it would not be an economical proceeding. Native stills, when worked properly, are run off with 80 per cent of the acid in combination containing only from 3 to 4 per cent of free HCl. Now, as tower salts (as the crude HCl is called) contain 28 per cent HCl, a ton of manganese liquor would only be worth $\frac{1}{7}$th of a ton of spirits of salts. Now tower salts can be bought at Widnes for 6s. 8d. per ton in boats, and this less 1s. 8d. for filling and loading is 5s., or making the value of still liquor for this purpose, on the supposition that all the free acid in it is as active as that in tower salts (which it is not) at 8$\frac{1}{2}$d. per ton—a price which would scarcely pay to transfer it from one vat to another.

4. The sulphuric acid in the still liquors would form

sulphate of lime with the soda-waste; and though it may be argued that this would be insoluble, yet on a manufacturing scale my experience of sulphate of lime has not been a favourable one, especially in acid solutions. There would also be cinders, silica, &c., to deal with.

5. By not calcining with salt, a great deal more copper would be left insoluble than by the present mode of working. It may be inferred that some of the copper sulphide would be oxidised and dissolved by reason of the presence of iron perchloride which is present in native still liquor; but this reaction is not new. It was patented by Gossage in March, 1859 (No. of patent, 594).

6. Mr. Wilson recommends that the pyrites should be crushed, ground, and baked, and states that it has the advantage of costing no more than breaking the large lumps with hammers. This is contrary to all experience, for when broken by Blake's crusher the cost is less than 6d. per ton of pyrites, whereas pyrites *smalls* generally cost 4s. per ton for labour, steam, fuel, and wear and tear, for grinding and baking into cakes. Every shilling expended upon the burnt pyrites means at least really 30s. per ton upon the copper produced.

7. With reference to the last paragraph of paper on page 65, it may be stated that the process (Haeffely's) is well known to most copper manufacturers, and has been carried on extensively by Messrs. Harrison, Blair, and Co., of Bolton, for many years, for the manufacture of sulphate of copper, with modifications of their own found necessary by practical working; and if I should be asked why a manufacturer should continue to work a process unless much superior to that generally employed, I may add that, when capital is invested in plant, to write that off is often a serious bar to the introduction of a new process which only pays slightly better. To those interested in new copper processes the following specifications may be of some use:—

Newton, No. 9748, May, 1843; Bankart, No. 10,805, August, 1845; Birkmyre, No. 11,966, November, 1847; Longmaid, No. 13,630, May, 1851; Bouch, No. 174, January, 1858; Gossage, No. 594, March, 1859; Henderson, No. 2900, December, 1859; Spence, No. 3154, December, 1860.

—I am, &c.,

George E. Davis.

Barton Arcade, Manchester,
February 16, 1879.

ON THE MOTIONS OF CAMPHOR, &c.

To the Editor of the Chemical News.

Sir,—I sent a correction last week, which seems to have arrived too late, to the effect that the specimen of naphthalin on my shelf, which was procured from Morson some years ago, rotates briskly on hot water, but not on cold. A friend has sent me a specimen of pure naphthalin which does not rotate either on hot or cold water, doubtless from being more insoluble than the other specimen; nor does the addition of a few drops of spirits of wine to the water assist it in rotating.

A curious practical application of the camphor motions has lately been recommended. Among the infinite resources of fraud the practice has lately been adopted of oiling wheat and other kinds of grain, for the purpose of increasing the weight. Cheap rape-oil is used, and it is said that fourpenny-worth of oil will increase the apparent value of a ton of wheat from 20s. to 25s., but I confess that I do not quite understand how. But the point is, what is the readiest mode of detecting the presence of the oil? It is recommended to scrape a few fragments of camphor on the surface of water, and then add a few of the grains. If they have been oiled they will at once arrest the camphor motions; if not oiled, the gyrations will continue.

I recommended this method of detecting traces of grease or of fixed oil in water many years ago, and it is described in Hardwich's "Manual of Photographic Chemistry," seventh edition, 1864, p. 111.—I am, &c.,

C. Tomlinson.

Highgate, N., February 18, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwis expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 2, January 14, 1878.

Presence of Oxygen in Metallic Silver.—M. Dumas.—The author, after referring to the discussion which has recently taken place on the fundamental principles of the atomic theory, admits that there is another question which has the most important bearing upon the very nature of matter, and which still remains open. Whilst the equivalents of simple bodies when compared with that of oxygen do not exhibit any appreciable relation, we had formerly merely to take the equivalent of hydrogen for unity in order to find that the equivalent of carbon might be taken as 6, that of oxygen as 8, that of nitrogen as 14, that of sulphur as 16, of calcium as 20, of iron as 28, &c. The equivalents of elementary bodies seemed therefore represented by multiples of the equivalent of hydrogen by whole numbers. For those who believe in the unity of nature these experimental results gave great force to their opinion, and rendered it permissible to suppose that the reputed elementary bodies might result from the simple aggregation of similar molecules varying merely in number or in arrangement in each case. These results have been called in question. From a mere practical point of view chemists may content themselves with the notions on the weights of equivalents already acquired. Such, however, is not the case in a purely philosophical light, and it was necessary that experiment should decide whether the equivalents of simple bodies are or are not multiples of one and the same fundamental unity of whole numbers. In this discussion it is not useless to remember that we have never been deceived by the balance, the most perfect of all instruments, but often, on the other hand, by faults in calculation, and especially by involuntary errors as regards the purity of the substances employed. Berzelius, the creator of numerical chemistry, convinced (as he had the right to be) of the precision of his experiments, maintained their rigour to the third decimal. But it would suffice to refer to a vacuum the apparent weight of the bodies upon which he operated— a correction which he had neglected—in order to modify the last decimals of his figures. As concerns the gases all the determinations of density made in the first years of the century, compared with that of hydrogen, vary a little from the simple ratios which they ought to present. Oxygen ought to appear 16 times as heavy as hydrogen, nitrogen 14 times, carbonic acid, 22 times, &c. Experiment certainly gave results approximating to these numbers, but deviations were still present which ought not to have been met with. It had not then been observed that every gas collected over a liquid has lost its purity, and that in order to operate upon a pure specimen it should be conveyed directly from the generating apparatus to that where it is to be operated upon. When this modification was introduced, the weights of nitrogen, of oxygen, and carbonic acid for one and the same volume became, we may say, exact multiples of the weight of hydrogen by whole numbers. We put aside, for the moment, as of no importance, the question whether this unity should be hydrogen itself, or double its weight, that is, 1 or 2, since we have to do, not with absolute numbers, but with ratios.

May we not consider the following figures, determined by experiment, as expressing ratios in whole numbers :—

Hydrogen	1·00
Carbon	6·02
Lithium	7·02
Oxygen	8·00
Nitrogen	14·04
Sulphur	16·02
Calcium	20·01
Sodium	23·04

Is there not here the indication of a natural law? The irregulatities, even where greatest, may they not be ascribed to an imperfection in the experiment rather than to the constitution of the bodies in question? I have never ceased pursuing the thought that to determine the absolute ratios of weight between the equivalents it is necessary, not merely to take materials very pure, reactions very simple, and weights referred to a vacuum, but to employ, further, some precautions which have been overlooked. I think I may now add that when it is needful to carry precision to its utmost limit we cannot, in many cases, consider the weight of bodies as exact until they have been kept in a vacuum at an elevated temperature unless they no longer evolve anything, and until the barometer connected with the apparatus remains at its normal height. It is not sufficient for bodies to remain for a long time in a vacuum in the cold, or for a short time in heat, or to be heated to redness at the common pressure. This may be shown by an example. Among the compounds which have played a part in the determination of equivalents the chloride of silver figures in the first rank. By reason of its insolubility any soluble chloride may be transformed into chloride of silver with such facility that these reactions afforded a very general means for ascertaining the equivalents of the elementary bodies. Still, if we compare the various syntheses of chloride of silver we find differences absolutely inexplicable. Thus, for 100,000 of silver, we find, according to—

Berzelius	132·700 of chloride
Marignac	132·842 ,,
Stas	132·850 ,,
Dumas	132·870 ,,
Gay-Lussac	132·890 ,,
H. Rose	133·014 ,,

Among these numbers which is the correct one? No one will call in question the skill of the experimentalists. We must seek the causes of the discrepancy in the circumstances of the experiment, aad they seem to lie in the state of the metallic silver used for conversion into chloride. Our colleague, M. Debray, had at my request prepared 1 kilo. of pure silver, using the common procedure for melting and granulating this metal, *i.e.*, fusion with the addition of a little borax and nitre—a method pursued by most of the experimentators who have determined its equivalent, or made use of it in the determination of others. I placed this silver in a flask of glazed porcelain connected with a Sprengel pump. I heated the flask, and soon, the temperature having risen to 400° or 500°, gas was evolved, and continued to escape for six hours, being collected in tubes over mercury. The flask was kept at from 500° to 600°, but without exceeding a dull red heat. When the disengagement ceased all the gas remaining in the flask was drawn out, and the temperature raised to the fusion of the silver. No further escape of gas took place. When the flask was cool a well-crystallised button of silver was found. The interior of the flask was partially covered with globules of distilled silver, but there was not a trace of that yellow tint which shows the formation of silver silicate. The button when carefully cleaned had the specific gravity 10·512, consequently higher than that generally ascribed to silver. The gas given off was pure oxygen, amounting in quantity to 57 c.c. at 0°, and 0·76 per kilo. of silver. Hence the silver experimented upon contained 999·918 grm. of silver and 82 milligrms. of oxygen. Another kilo. of silver, into which small successive portions of nitre were thrown during fusion, was found to contain 226 milligrms. of oxygen, and only 999·774 grms. of real silver. It appears from these trials that in the very numerous experiments for the determination of equivalents which have been made with the intervention of silver the chemists who, having taken the necessary precautions for the purification of this metal, have granulated it after previous fusion in presence of borax, nitre, and air, have placed it in the proper circumstances for the absorption of oxygen in proportions varying from 50 to 200 c.c. per kilo. These quantities are calculated to exercise a notable influence upon the results deduced from the synthesis of silver chloride, or the very numerous experiments which have served for determining the weights of elements by finding the quantity of silver necessary for the decomposition of their chlorides. The oxygen augments the apparent weight of silver employed, and diminishes the weight of the chloride obtained. The ratio of the chlorine to the silver is therefore necessarily altered. The results obtained by Marignac and Stas, or even by Berzelius, in place of the proportion 108:35·47 would give 108:35·50, as found by Gay-Lussac and the author, if the correction for the presence of oxygen were applied to their experiments. But there remain other objections to be raised before the problem of the numerical relations existing between the equivalents of simple bodies can be considered as solved. The conditions of this reciprocal action of oxygen and silver deserve a close examination. If the metal is heated to dull redness in a vacuum, a moment arrives when, all the gas present having been extracted, if the silver is fused and oxygen permitted to re-enter the apparatus, it is absorbed rapidly. The mercury re-ascends, and keeps at the height of 48 to 50 centimetres for entire hours, even at a temperature at which porcelain softens. We may thus determine the tension of the solution of oxygen in melted silver, or the tension of dissocia- of the compound, if we consider the product as a chemical combination. If the apparatus is allowed to cool the silver is solidified, and a sudden escape of oxygen takes place, but the metal, even in a vacuum, does not give off anything approaching to the quantity of oxygen absorbed. Thus, according to these experiments, silver which has absorbed oxygen does not lose it in the cold in a vacuum. At from 400° to 600°, in a vacuum the escape is rapid, but tends to cease above a cherry-red heat. When the silver softens, and especially when it melts, the phenomenon is reversed, and the absorption of oxygen becomes rapid. On solidification a quantity of the oxygen is lost, though considerable quantities are still retained. The experiments of Lucas, Chaudet, Gay-Lussac, and Graham have shown that silver possesses the power of dissolving oxygen, and of losing a part again on solidification. If this fact has not been taken into account in the delicate researches to which this metal has been devoted it is because the oxygen was supposed to have entirely escaped at the moment of solidification. The interesting researches of M. F. Le Blanc on the power which litharge possesses of dissolving oxygen on fusion, and losing it again on cooling, refer doubtless to a phenomenon of the same class.

Formation of Oxygenated Water, Ozone, and Persulphuric Acid during Electrolysis.—M. Berthelot.—Faraday first remarked that the electrolysis of dilute sulphuric acid yielded a volume of oxygen less than one-half that of the hydrogen simultaneously disengaged, and ascribed this phenomenon to the formation of oxygenated water. After having recapitulated the various explanations suggested by other chemists and physicists, the author maintains that the oxidising compound formed during electrolysis cannot be oxygenated water nor yet ozone. It is, further, only formed during the electrolysis of sulphuric solutions, a circumstance which points to the identity of the substance in question with persulphuric acid. The three bodies—oxygenated water, ozone, and persulphuric acid—may all be simultaneously formed during electrolysis, but in small quantity and in variable proportion.

Stability of Ozone.—M. Berthelot.—The speed of the destruction of ozone is so much the greater the richer is the gas. Ozone has no finite point of dissociatory temperature, which agrees with its endothermic formation.

Note in reference to the Report of the Last Session.—M. Pasteur.—The author complains of the manner in which M. Trecul has described his researches on moulds.

The Vibrations of Matter, and the Undulations of the Ether as probable consequences of the fact which serves as a basis for the Mechanical Theory of Heat.—M. Favé.—Not adapted for abstraction.

Liquefaction of Gases.—M. Cailletet.—The author enclosed in the tube of his pressure apparatus dry air deprived of carbonic acid, and refrigerated the upper part of the tube *only* with nitrous oxide. When the pressure had reached 200 atmospheres, small threads, doubtless liquid, were seen to flow down the lower part of the tube. Ether when flowing in a tube presents the same appearance. When these threads came in contact with the mercury below the refrigerant, the pressure was then increased to 255 atmospheres, when the liquid threads became more numerous and more distinct. At 310 the mercury was frozen, and was covered with hoar-frost, doubtless frozen air.

On Telephony.—M. Breguet.—M. Salet, inverting the application of the principle of Edison, has constructed a telephone founded on the varying conductibility produced by the contact between a piece of graphite and one or more points of metallic sponge. He has also experimented with various substances of but moderate conducting power, among others with gas-coke.

Investigation of the Ultra-violet Solar Spectrum.—M. A. Cornu.—These researches may be regarded as a continuation of Angström's memoir on the "Normal Solar Spectrum," and its extension beyond the visible portion, comprehending all the ultra-violet part of the spectrum. The first part of the paper relates to that portion of the ultra-violet spectrum observable with ordinary laboratory spectroscopes fitted with object-lenses and prisms of glass. It extends from the ray h' ($\lambda=410{\cdot}10$) to the ray O ($\lambda=343{\cdot}97$). The second part extends from O to the extreme ultra-violet observable with a spectroscope with lenses of quartz and a prism of Iceland spar. This limit correspond to the ray U ($\lambda=294{\cdot}80$). The author has succeeded in determining the wave-lengths of the rays O, P, Q, R, *r*, and S with direct solar light. The variable limitation of the ultra-violet part of the spectrum is due to atmospheric absorption, and its extent varies in the same ratio as the height of the sun above the horizon. At equal heights, however, the spectrum is much more extended in winter than in summer. Hence the absorption seems mainly due to the watery vapour in the atmosphere, which is much more abundant in summer than in winter.

Fertility of Volcanic Soils.—M. Truchot.—The author points out that Dr. Gavazzi, in treating on the same subject, has made no mention of the phosphoric acid present to a notable extent in such soils.

Liquefaction of Hydrogen.—Raoul Pictet.—The author obtained hydrogen by decomposing potassic formiate by potassa. The hydrogen thus escaped is perfectly dry, and the residue is not volatile. The pressure reached 650 atmospheres before becoming stationary. The cold was about $-140°$. On opening the cock the liquid hydrogen escaped with vehemence, marking a sharp hissing sound. The jet had a steel-blue colour, and was perfectly opaque for the length of 12 centimetres. At the same moment a rattling was heard like that made by hail when it falls upon the ground, and the hissing became transformed into a peculiar noise, resembling that made by a fragment of sodium thrown upon water. Almost immediately the jet became intermittent, and shocks were felt in the cock at each escape. During the first jet the pressure fell from 650 atmospheres to 370. After closing, it gradually fell for several minutes down to 215 atmospheres, and then slowly rose to 225, where it became anew stationary. On re-opening the cock the jet issued in so intermittent a manner that it became evident that the congelation of hydrogen had taken place in the tube. This hypothesis was demonstrated by the progressive escape of all the hydrogen when the pumps were stopped, and the production of cold arrested.

Justus Liebig's Annalen der Chemie,
Band 190, Heft 1 and 2.

Hydrazin Compounds.—Emil Fischer.—A prolonged treatise, utterly incapable of useful abstraction.

Determination of Caustic Alkali in presence of Alkaline Sulphides and Carbonates.—This process is well adapted for the analysis of ball-soda. The weighed sample is ground up under alcohol till all the caustic alkali is dissolved, heat being applied if necessary, and to the cold concentrated solution CS_2 is added. The liquid is largely diluted with water; the alkaline sulphides and sulpho-carbonates are removed by the addition of a solution of lead or zinc, avoiding excess, when the caustic alkali may be calculated from the quantity of the xanthogenate found. For the determination of cupric salts no further preparation is needed than weighing, solution in water, and the addition of much salt of Seignette. If the solution is acid it is previously neutralised with sodium carbonate, and then titrated with a solution of xanthogenate of a known strength till the last signs of turbidity cease in the liquid. The approaching end of the operation is indicated by the disappearance of the greenish blue colour. The solution of xanthogenate of potassium is unfortunately not permanent.

Communications from the Laboratory at Greifswald.—These consist of a paper, by Dr. G. Heinzelmann, on certain derivatives of meta-disulpho-benzolic acid.

Relative Affinity of Oxygen for Hydrogen and Carbonic Oxide.—A. Horstmann.—If aqueous vapour is present before combustion the proportion of aqueous vapour formed by combustion is diminished, and the consumption of carbonic oxide promoted. On the other hand, the previous presence of carbonic acid causes the combustion of more hydrogen and less carbonic oxide.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 5, January, 31 1878.

Duter's Artificial Magnets.—M. Duter has exhibited magnets made by submitting circular plates of steel to the action of an electro-magnet terminating in a conical point applied to the centre of the disc. In these magnets the neutral line is circle of the disc, concentric with the ray—

$$\frac{R}{V^2}.$$

Experiments with the Telephone.—A. Demoget.—If two telephones are placed in direct communication with the two wires of a Ruhmkorff's coil so as to close the currents of each of them by means of the wires, and if anyone speaks into either of the instruments, the second transmits the sounds as if the two telephones were in direct communication. If anyone speaks into a telephone in connection with the thick inducting wire the coil acts as if with a battery, although the currents are alternately inverted, and very feeble discharges are produced at the extremity of the induced wire on bringing them into contact with the tongue by means of two wires of fine copper. The voices of women and children are heard better with vibrating plates of 3 to 5 centimetres in diameter, and the voices of men with plates of 6 to 8 centimetres. If the gamut is sung into a telephone with a large vibrating plate the lowest notes are easily heard, whilst the higher

ones become less distinct. If the vibrating plate is small the case is reversed. At the end of a line two telephones may be placed in a double circuit, and if we speak or sing simultaneously into both the two voices are heard distinctly in a single telephone at the other extremity of the line.

Xylophilin.—This substance, the cause of the violet shade which certain vegetable membranes display on contact with hydrochloric acid, is a colourless substance, soluble in water and alcohol, found in more than 60 per cent of woody plants, and 30 per cent of herbaceous plants.

No. 6, February 7, 1878.

This issue, except the discourses pronounced at the funerals of M. Becquerel and M. Regnault, contains merely the proceedings of the Academy of Sciences.

Die Chemische Industrie, Vol. I., No. 1, January, 1878.

This new contemporary is the organ of the recently-founded association for promoting the interests of the chemical manufactures of Germany.

The present issue contains a paper by Dr. H. Gericke on the excise-duty on charcoal in Germany, with its bearings upon the chemical arts. R. Hasenclever contributes a paper on the soda manufacture of Germany, from which it appears that since the reduction of the duty in 1873 the production of soda has fallen from 58,000 to 42,500 tons yearly, whilst the imports have risen from 14,000 to 32,000 tons. He considers that the continental alkali works cannot withstand English competition without the aid of protective duties. The same writer gives an account of Thelen's apparatus for the concentration of lyes, saline waters, &c., which, however, cannot be usefully described without the accompanying illustration.

363*me Lettre-Causerie. Publication Scientifique Hebdomadaire.*

This issue contains a full account of the process of MM. Fremy and Feil for the manufacture of artificial minerals.

NOTES AND QUERIES.

Replacing Acids.—I should be glad if any of your correspondents could tell me a ready way of substituting H_2SO_4 for HCl and HNO_3 in combination) in solutions, on the manufacturing scale, without evaporating to dryness.—A SUBSCRIBER.

MEETINGS FOR THE WEEK.

MONDAY, 25th.—Medical, 8.
—— Royal Geographical, 8.30.
—— Society of Arts, 8. "The Application of Photography to the Production of Printing Surfaces and Pictures in Pigment," T. Bolas, F.C.S.
TUESDAY 26th.—Civil Engineers, 8.
—— Royal Institution, 3. "Protoplasmic Theory of Life, and its Bearing on Physiology," Professor Garrod.
—— Anthropological, 8.
WEDNESDAY, 27th.—Society of Arts, 8. "The Past, the Present, and the Future of the River Thames," J. B. Redman.
THURSDAY, 28th.—Royal, 8.30.
—— Royal Institution, 3. "Chemistry of the Organic World," Prof. Dewar.
—— Philosophical Club, 6.30.
—— Society of Arts, 8. "The Chemistry of Infection, or the Germ Theory of Disease from a Chemical point of view," C. T. Kingzett, F.C.S.
FRIDAY March 1st.—Royal Institution, 8. Weekly Meeting. "On the Deterioration of Oil Paintings," Dr. Leibreich, 9.
—— Archæological Institute, 4.
SATURDAY, 2nd.—Royal Institution, 3. "Carthage and the Carthaginians," R. Bosworth Smith, M.A.
—— Physical, 3. "On the Phonograph," W. H. Preece, C.E.

Lately published, 1091 pages, with Illustrations, 8vo., £1 11s. 6d.,

EXPERIMENTAL RESEARCHES IN PURE, APPLIED, AND PHYSICAL CHEMISTRY. By E. FRANKLAND, Ph.D. (Marburg), D.C.L., F.R.S., Professor of Chemistry in the Royal School of Mines, &c. The work includes investigations on the Manufacture and Illuminating Power of Gas, on the Water Supply of Towns, and the Purification of Drainage from Towns and Manufactories.

"We can point students to the volume before us for a clear and detailed account of some of the most remarkable researches of our time in synthetic chemistry."—*Nature*, Jan. 17, 1878.

JOHN VAN VOORST, 1, Paternoster Row.

Chemical Technology, or Chemistry in its Applications to the Arts and Manufactures. By THOMAS RICHARDSON and HENRY WATTS. Second Edition, illustrated ith numerous Wood Engravings.

Vol. I., Parts 1 and 2, price 36s., with more than 400 Illustrations.

Nature and Properties of Fuel: Secondary Products obtained from Fuel: Production of Light: Secondary Products of the Gas Manuacture.

Vol. I., Part 3, price 33s., with more than 300 Illustrations.

Sulphur and its Compounds: Acidimetry: Chlorine and its Bleaching Compounds: Soda, Potash: Alkalimetry: Grease.

Vol. I., Part 4, price 21s., 300 Illustrations.

Aluminium and Sodium: Stannates, Tungstates, Chromates, and Silicates of Potash and Soda: Phosphorus, Borax: Nitre: Gun-Powder: Gun Cotton.

Vol. I., Part 5, price 36s.

Prussiate of Potash: Oxalic, Tartaric, and Citric Acids, and Appendices containing the latest information, and pecifications relating to the materials described in Parts 3 and 4.

BAILLIERE AND CO., 20, King William Street, Strand.

South London School of Pharmacy, 325, Kennington Road. Managing Director, DR. MUTER.
Daily Lectures on the following subjects:—

CHEMISTRY.	MATERIA MEDICA.
BOTANY.	PHARMACY.
PHYSICS.	CLASSICS.

The School has accommodation for 120 Students, and contains an excellent Museum and a very completely fitted Chemical Laboratory for 50 Junior and 20 Senior Pupils, with water and gas at everyworking bench.

For all particulars, enclose a stamped envelope to the Secretary, Mr. W. BAXTER, at his office, Central Public Laboratory, Kennington Cross, London, S.E.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

J. I. HEADLY, ENGINEER, Cambridge, Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street, London.

ERECTION OF PLANT.

TO SULPHATE OF AMMONIA MANUFACTURERS AND OTHERS.

STILLS, SATURATORS, and all APPARATUS in connection with the above Erected upon the Most Approved Plan—result of 15 years practical experience.—Address, G. Tunbridge, Man. Chem. Dept., Gas Works, Leicester, or J. Barnes, Plumber, &c., Barking, Essex.

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

THE CHEMICAL NEWS.

Vol. XXXVII. No. 953.

ON THE ACTION OF SODIUM ON CHINOLINE AND LEPIDINE.

Preliminary Notice.

By C. GREVILLE WILLIAMS, F.R.S.

In a paper "On the Higher Homologues of Chinoline" * I mentioned that, on treatment with sodium, these bases yield a very beautiful substance, which communicates to silk a fine orange colour. I have lately repeated these experiments with sodium-amalgam containing 10 per cent of sodium.

When the amalgam is added to chinoline or lepidine the mixture heats, turns reddish brown, and at last solidifies. The addition of water causes a yellowish oil to separate. This oil, boiled with water and an acid, affords a deep reddish brown solution, which, on cooling, deposits crystals of a superb scarlet colour. In one case, where the chinoline had been purified by conversion into the chromate, the salt surpassed the finest vermillion in tint. The drying must be effected in the dark, as the crystals are altered in colour by light. The same may be said of silk or wool dyed with this substance.

A preparation made with chinoline, and boiled out with hydrochloric acid, gave on analysis—

Carbon	73·5
Hydrogen	5·6

The formula $C_{18}H_{14}N_2.HCl$ requires—

Carbon	73·3
Hydrogen	5·1

The substance would therefore appear to be the hydrochlorate of di-chinoline.

Lepidine was then treated, as described, with sodium-amalgam, and the resulting oil boiled with dilute nitric acid. The solution, on cooling, gave a crop of red crystals, which on combustion afforded the following numbers :—

Carbon	68·8
Hydrogen	5·7

The nitrate of di-lepidine, $C_{20}H_{18}N_2.HNO_3$, requires—

Carbon	68·8
Hydrogen	5·4

The subject is still under investigation.

Star Chemical Works, Fulham,
February 21, 1878.

ON DYER'S CHEMICALS.

By J. MARZELL.

(Continued from p. 76.)

Alcoholic Derivatives of Diphenylamin.

Methyl-diphenylamin.

To prepare this body, Girard and De Laire took patents in France (June 30, 1869)* and England (December 18, 1869).† Almost at the same time M. Bardy took a patent for this matter. The principal methods are the following :—

(1.) Action of $\left\{\begin{matrix}\text{iod-methyl}\\ \text{methyl-nitrate}\end{matrix}\right\}$ upon diphenylamin below 100° C. :—

$$\left.\begin{matrix}(C_6H_5)_2\\ H\end{matrix}\right\}N + ICH_3 = \left.\begin{matrix}(C_6H_5)_2\\ CH_3\end{matrix}\right\}N + IH.$$

(2.) Action of methyl-aniline upon hydrochlorate of aniline (Girard and De Laire) :—

$$\underbrace{N\left\{\begin{matrix}C_6H_5\\ CH_3\\ H\end{matrix}\right.}_{\text{Methyl-aniline.}} + \underbrace{N\left\{\begin{matrix}C_6H_5\\ H\\ H\end{matrix}\right.}_{\text{Aniline.}} + HCl = \underbrace{N\left\{\begin{matrix}C_6H_5\\ CH_3\\ C_6H_5\end{matrix}\right.}_{\text{M.-diphenylamin.}} + NH_4Cl.$$

(3.) Action of methyl-alcohol upon the anhydrate of the hydrochlorate of diphenylamin (Berthelot, Bardy).

(4.) Action of methyl-alcohol and hydrochloric acid upon diphenylamin (Ch. Girard).

Nos. 3 and 4 rest upon the action of methyl-chloride in *status nascendi* upon the diphenylamin. At a certain temperature the unstable hydrochlorate is decomposed into its ingredients, leaving the free hydrochloric acid able to operate upon the methyl-alcohol, yielding methyl-chloride—which immediately enters into reaction with the diphenylamin—and water :—

$$\text{I. } CH_3OH + HCl = CH_3Cl + H_2O.$$

$$\text{II. } \left.\begin{matrix}(C_6H_5)_2\\ H\end{matrix}\right\}N + CH_3Cl = \left.\begin{matrix}(C_6H_5)_2\\ CH_3\end{matrix}\right\}N + HCl.$$

Even No. 4 does not require so high a pressure and temperature as has to be supplied in following No. 3.

In an enamelled autoclave, able to hold about 60 galls., and proved for a pressure of 600 to 750 lbs., 200 lbs. of diphenylamin, 136 lbs. of hydrochloric acid (1·2 sp. gr.), and 50 lbs. of methyl-alcohol are mixed, and heated up to about 200° to 250° C. for ten to twelve hours. The pressure generally does not rise above 150 lbs. The vessel is plunged into an oil-bath. If the reaction is over the whole is allowed to cool down, the tube opened, and the mass taken out. Brought into an enamelled iron tank, a hot solution of caustic soda is added in a slight excess. The crude methyl-diphenylamin, and the unattacked diphenylamin separare, and are taken off and distilled. The temperature wanted is about 290° to 300° C.

For purifying the distillate, it is put into an enamelled iron or wooden tank, and treated with about 230 lbs. concentrated hydrochloric acid; a slight heat supplied if necessary. In cooling, the HCl diphenylamin crystallises out, and is separated by filtering. To the solution containing the methyl-diphenylamin as hydrochlorate about 250 galls. of water are added, intimately mixed, and then the liquid allowed to settle for about ten hours.

The hydrochlorate of methyl-diphenylamin is decomposed. The free base gathering on the surface is digested, washed with a slight alkaline solution, and then with hot and cold water, and finally distilled. In this way a nearly colourless liquid is obtained, distilling between 282° to 286° C. The methyl-diphenylamin is only little soluble in alcohol, better in ether and benzol. Its salts are unstable, and are undecomposed by water.

$$\text{Ethyl-diphenylamin, } N\left\{\begin{matrix}C_6H_5\\ C_6H_5\\ C_2H_5\end{matrix}\right.$$

This base is to be obtained in an analogous manner as the methyl derivative, with the only difference, that instead of methyl, ethyl alcohol (C_2H_5OH) has to be taken. It is an oily liquid, boiling between 295° to 300° C., easily soluble in ether and benzol. Its salts can be decomposed with water.

$$\text{Amyl-diphenylamin, } N\left\{\begin{matrix}C_6H_5\\ C_6H_5\\ C_5H_{11}\end{matrix}\right.$$

Formed in an analogous manner as the foregoing, but higher temperature and pressure have have to be applied.

* "The Laboratory," i., 109.
* Attition au Brevet concernant la Diphenylamin.
† No. 3675.

Oily liquid, distilling between 335° to 345° C. Its basic character is nearly gone. Less soluble in alcohol than the methyl and ethyl derivatives. Benzol dilutes it in large quantities.

Benzyl-diphenylamin, $N\begin{cases}C_6H_5\\C_6H_5\\C_7H_7\end{cases}$

This body can be obtained by action of benzyl-chlorure upon diphenylamin :—

$$C_7H_7Cl + \left.\begin{matrix}C_6H_5\\H\\C_6H_5\end{matrix}\right\} N = N\begin{cases}C_6H_5\\C_7H_7\\C_6H_5\end{cases} + HCl.$$

It is solid, soluble in alcohol, ether, and benzol, separating from these liquids in splendid crystals.

(To be continued).

APPLICATION OF ORGANIC ACIDS TO THE EXAMINATION OF MINERALS.*

By H. CARRINGTON BOLTON, Ph.D.

(Continued from p. 67).

Metals and Organic Acids.

11. That citric and tartaric acids dissolve iron and zinc, with evolution of hydrogen gas, is a well-known fact, stated in many handbooks of chemistry.†

Crommydis has recently taken advantage of the solubility of zinc in oxalic acid to prepare glycollic acid ($H_2C_2H_2O_3$), a reaction in which nascent hydrogen plays an important part.‡

In repeating and extending these experiments we have made the following observations: Iron, zinc, and magnesium dissolve readily in cold saturated solutions of citric, tartaric, oxalic, and malic acids, as well as with formic (sp. gr. = 1·060) and acetic acids (sp. gr. = 1·037), evolving hydrogen more or less freely; on heating, the action becomes violent. Magnesium is attacked by citric and other acids violently, the liquid becoming much heated.

A cold saturated solution of citric acid, diluted with half its volume of water, attacks zinc slowly in the cold; on boiling, hydrogen comes off freely and continues to do so after cooling for a long time; the disengagement of gas being slow but steady, and under favourable conditions lasting for twenty-four hours. If the solution becomes very concentrated, an insoluble citrate of zinc precipitates, soluble, however, in water.

Tartaric acid acts on zinc feebly in the cold; on boiling, solution ensues, and at the same time the hot liquid becomes milky from the formation of an insoluble tartrate of zinc; on cooling, the solution becomes clear and a precipitate settles.

Oxalic acid in concentrated solution attacks zinc in the cold immediately; but the action soon ceases, owing to the surface of the zinc becoming coated with a quite insoluble zinc oxalate; on heating to boiling, the evolution of hydrogen is resumed, but is again arrested in a short time from the same cause. On cooling, a fine precipitate forms.‖

Sulphides.

12. After experiencing the solvent power of organic acids described in the preceding section, we were prepared to discover many sulphides yielding to them, though we confess to surprise at finding this action taking place even in the cold. Such is the case with four out of the eighteen sulphides selected for examination, viz., stibnite, galenite, sphalerite, and pyrrhotite. The tests were made as follows: The pulverised minerals were placed in test-tubes, a concentrated solution of citric acid was added, and a piece of paper moistened with plumbic acetate was suspended in each tube, which was then corked. After standing twelve hours at the ordinary temperature, the blackened test-papers gave evidence of the decomposition. Sphalerite seems to be the most readily decomposed, the sulphuretted hydrogen coming off immediately. On heating, the disengagement of sulphuretted hydrogen is very marked; with boiling citric acid, bornite and bournonite, in addition to those just mentioned, yield sulphuretted hydrogen. One sample of argentite, containing mingled galenite, gave a reaction for sulphuretted hydrogen; but a purer specimen was not attacked. With bournonite the reaction is feeble.

Pyrite, marcasite, molybdenite, charcolite, cinnabar, argentite, niccolite, smaltite, chalcopyrite, ullmannite, arsenopyrite, and tetrahedrite, resist the action of citric acid. Tartaric and oxalic acids act in a similar manner, both in the cold and on boiling. A comparison of the behaviour of nine organic acids with stibnite gave the following results :—

(*a*) Stibnite, heated with citric, tartaric, and oxalic acids, yields sulphuretted hydrogen freely and goes into solution.

(*b*) With malic, benzoic, and pyrogallic acids, sulphuretted hydrogen comes off feebly and the mineral dissolves imperfectly.

(*c*) With formic and acetic acids no gas is evolved and the mineral is not dissolved.

(*d*) With picric acid no gas is evolved, but the mineral is partially dissolved.

It is noticeable that the *liquid* acids are powerless to effect decomposition. (Section 8.)

13. The action of the organic acids on mineral sulphides is not so decided as that of the mineral acids; but this is no disadvantage, since it affords additional means of determining them. On examining the reactions recorded in the preceding section, it will be found that bornite and pyrrhotite are decomposed by citric acid, while their kindred compounds, pyrite and chalcopyrite (as well as chalcocite), are not. In order to establish satisfactorily this difference of behaviour, several specimens of each of these minerals, from various localities, were carefully tested.

(*a*) Four samples of bornite were heated with a concentrated solution of citric acid, and each gave a strong reaction for sulphuretted hydrogen; of four specimens of chalcopyrite, treated in the same manner, two gave no traces of this gas, and two gave mere traces on long boiling; three samples of chalcocite yieded no traces of sulphuretted hydrogen.

(*b*) Three specimens of pyrite heated with citric acid gave no traces of the gas, and three of pyrrhotite liberated it both in the cold and freely on boiling. On the other hand, all the specimens named are decomposed by hydrochloric acid, except one specimen of pyrite (from Germany).

It is evident, then, that citric acid may be used to distinguish pyrrhotite from pyrite, and bornite from chalcocite or chalcopyrite. The presence of galenite in argentite may also be ascertained by this method, since the former yields H_2S even in the cold, while the latter is not decomposed on boiling.

---

* Read before the New York Academy of Sciences, April 30, 1877.

† "Cf. Handwörterbuch der Chemie," article "Citronsäure."

‡ *Bull. Soc. Chim.*, xxvii., p. 3, 1877.

‖ Experiments were made to test the applicability of these methods of generating hydrogen to the detection of arsenic by Marsh's apparatus. If a solution containing arsenic be introduced into a flask in which hydrogen is evolved from the action of citric acid on zinc, the disengagement of gas is greatly augmented and arseneted hydrogen forms at once. Owing to the imperfect solubility of zinc citrate, the action soon ceases. With tartaric acid the same objection arises, while oxalic acid is out of the question. This difficulty does not apply to magnesium, which might be employed in an apparatus similar to that described by Dr. John C. Draper (*American Chemist*, ii., 456). By using distilled magnesium and re-crystallised citric acid, the absence of arsenic in the materials used for toxicological researches could be placed beyond suspicion.

Oxides.

14. A few of the mineral oxides examined are attacked by the organic acids in the cold; brucite dissolves slowly, but to a considerable extent, in cold citric acid; the manganese oxides, hausmannite, pyrolusite, manganite, psilomelane, and wad, decompose the organic acid with evolution of carbonic anhydride; the reaction begins in the cold, and on applying heat proceeds rapidly with a lively effervescence.

$$9MnO_2 + 10H_3C_6H_5O_7 = 9MnHC_6H_5O_7 + 13H_2O + 6CO_2.$$

Manganite is not so soluble as the others, probably because the oxidising power of the sesquioxide is less than that of manganese dioxide. The minerals are apparently more quickly and completely dissolved by oxalic acid than by citric acid.

Zincite, cuprite, and limonite are attacked by boiling citric acid, the latter but slightly. Hematite, magnetite, franklinite, and chromite are not attacked. In testing these minerals, conclusions were based on the reactions of the filtrates; in employing ferrocyanide of potassium to test the citric acid solutions of the iron oxides, we observe that the organic acid exerts a reducing action on the ferrocyanide, and produces a bluish precipitate proceeding from this reagent itself. This is especially noticeable on boiling, a light bluish green precipitate forming abundantly. Tartaric and oxalic acids act similarly.

The oxides behave with tartaric acid in all respects as with citric.

Sundry Minerals.

15. A few minerals not closely related were examined as to their behaviour with citric acid. Gypsum appears to be somewhat more soluble in a concentrated solution of citric acid than in water. Apatite is feebly attacked on boiling. Vivianite is readily soluble. Pyromorphite and anglesite are partly decomposed even in the cold, as shown by the behaviour of the filtrates with hydrosulphuric acid.

Fluorite, cryolite, and samarskite are not attacked, as might be anticipated.

Silicates.

16. Those silicates which are decomposed by hydrochloric acid, either with or without the formation of a jelly, are likewise attacked more or less strongly by a hot solution of citric acid. The minerals were examined as follows:—Their behaviour with strong hydrochloric acid was first ascertained, and they were then heated with a concentrated solution of citric acid; the solution becomes viscid by concentration, and the gelatinous silica is best seen by diluting with water and agitating. Very careful pulverisation of the mineral is in most cases indispensable. The solubility of the mineral was also tested by filtering from the silica and undissolved material, and examining the solution with an appropriate reagent. Owing to the power possessed by citric acid (in common with other organic bodies) of preventing precipitation of salts which are otherwise insoluble, care was had to select those reagents which were least affected; in this we were aided by a table contained in Dr. Hermann Grothe's paper, entitled, "Ueber das Verhalten der Metalloxydauflösungen gegen Alkalien bei Gegenwart nicht-flüchtiger organischer Substanzen und ueber den Nachweis der Metalloxyde in solchen Lösungen."*

So far as possible, colour reactions were employed.

The results are summarised below:—1, signifying minerals which decompose readily; 2, those which are attacked with difficulty; 3, those which resist the acid. Minerals which yield gelatinous silica are marked G, and those which give slimy or pulverulent silica, S.

* *Journ. für Prakt. Chemie*, vol. xcii., p. 175.

Behaviour of Certain Silicates with HCl *and with Citric Acid.*

Mineral.	HCl.	C.
Wollastonite	1G	1S
Chrysolite	1G	2
Olivine	1G	3
Willemite	1G	1G
Wernerite	1-2	3
Chondrodite	1G	1-2G
Datolite	1G	1G
Pectolite	1G	1G
Chrysocolla	1	1
Calamine	1G	1G
Prehnite	1	2
Apophyllite	1S	2S
Rhodonite	1	1
Natrolite	1G	1G
Analcite	1S	1S
Chabazite	1S	1S
Stilbite	1	2
Serpentine	1S	1S
Retinalite	1S	1S
Chrysotile	1S	2-3
Deweylite	1S	1S
Talc	3	3
Epidote	3	3
Orthoclase	3	3

In order to ascertain approximately the comparative decomposing power of the commoner organic acids with silicates, two which yield readily to citric acid and one which is attacked with difficulty were selected for treatment. The following are the results:—

	Calamine.	Natrolite.	Prehnite.
Citric acid	1G	1G	2
Tartaric acid	1G	1G	3
Oxalic ,,	2	3	3
Formic ,,	1G*	1	3
Malic ,,	1G	1G	3
Acetic ,,	1G	2-3	3

* Very soluble.

Since calamine and willemite are sometimes distinguished by their behaviour with acetic acid—the former gelatinising and the latter giving slimy silica—it was thought of interest to examine their behaviour with other organic acids. The results are given below:—

	Calamine.	Willemite.
Citric acid	1G	1G
Tartaric acid	1G	1*
Oxalic ,,	2	2
Formic ,,	1G	1S
Malic ,,	1G	1
Acetic ,,	1G	1S

* Solution becomes very milky in appearance.

(To be continued)

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, February 21, 1878.

Dr. J. H. Gladstone, F.R.S., President, in the Chair.

After the announcement of visitors, reading of minutes, &c., the following certificates were read for the first time:—T. H. Norton, J. Tchermiac. The following gentlemen were elected Fellows:—L. T. Wright, W. Hudson, T. Lichtenstein, G. S. Johnson, and W. B. Lowe.

It was then announced from the Chair that the following would retire from the Office of Vice-President:—Dr. Gilbert and Dr. Stenhouse; from the Council—Dr.

Attfield, and Messrs. Phillips, Tuson, and Hyde Hills. The names proposed to fill the above vacancies were—as Vice-Presidents, Prof. N. S. Maskelyne, and Dr. Angus Smith; as members of the Council, Dr. Tilden, and Messrs. Riley, Warington, and Carteighe.

The President then called upon Mr. J. Y. Buchanan to deliver his lecture, "*Laboratary Experiences on Board the Challenger.*" Mr. Buchanan commenced by describing to the Society his laboratory. It was 10 feet long, 5 feet 8 inches broad, and 6 feet high, and although the dimensions seemed small there was practically quite room enough for one worker. The laboratory was situated in the middle of the ship on the main deck on the starboard, *i.e.*, the right hand side looking forwards. A locker, 2 feet 6 inches high and 2 feet broad, ran across the whole of the front side of the laboratory. Supposing that the visitor takes his seat on this locker, looking aft, the following description will convey a rough idea of the interior. Immediately on his left is a gun-port, which, in the absence of the gun, provides light and ventilation for the room; some light is also obtained from windows in the deck. The locker contains the stores of glass and porcelain, a balance, microscopes, &c. On the right is the blowpipe table; a spirit-lamp, formed of a wide mouth stoppered bottle and having a large wick, was found to yield the most convenient flame; a tallow lamp was abandoned on account of the trouble of melting the tallow. On the left hand side, further aft, is seen the principal working bench, 3 feet 10 inches high, furnished with drawers containing the reagents, each bottle in a separate compartment; on the top of the bench battens are nailed so that the bench presents the appearance of the frame of an ordinary door without the panels; into the places where the panels should be the drawers of reagents can be fitted while in use, and so are prevented from shaking down. Ordinary retort stands were found to be useless, and the following stands were used:—A half-inch metal rod was taken and a long eye cut out at one end, like a needle. Into this eye fitted a staple, driven into the joists forming the roof of the laboratory. By this arrangement the retort rod had a certain play up and down. The retort rings, having been slipped on from the bottom, the rod was lifted, and then pushed down into a hole made for the purpose in the teak bench. This plan was found very convenient, and when not in use the rods were turned up, the eyes forming a pivot, and hooked along the roof. For evaporating, drying, &c., a cast-iron frame, set in gimbals, and fixed to the side of the laboratory, was found quite sufficient, even during the most violent movements of the ship. In the further left hand corner are the sink and the distilled water vessel. Along the further end are wooden shelves with holes for various pieces of glass apparatus; many vessels, &c., were slung from and between the beams supporting the deck. On the right hand side are seen the bottles of standard solutions with burettes; the latter were made like pipettes, and filled by sucking up the solutions from below; in this way barium hydrate solution was found to keep its titre for two to three months, though used every day. On the same side the specific gravity apparatus, hydrometers, and piezometers were stowed away. The lecturer stated that in all ordinary weathers, and in fact as long as the port which lighted and ventilated his laboratory could be kept open, he found no difficulty in working on board ship.

Mr. Buchanan then proceeded to explain the various investigations he had carried out as to the compressibility of distilled and sea-water, mercury, glass, &c. Before starting it seemed to him very desirable to have some means of checking the depths as indicated by the sounding-line, and it was clear that some sort of barometric method must be used. Air had already been tried without success, and so water was finally adopted. The piezometer used consisted of a thermometer, the bulb having a capacity of about 9 c.c., the stem being 13 inches long and 1 m.m. in diameter. The thermometer was inverted, after filling with water, in a little flask filled with mercury; the neck of the flask is connected to the stem by a short piece of india-rubber tubing, between which and the stem a piece of glass rod is inserted so as to admit the external pressure to the surface of the mercury. By warming the bulb enough water is forced out to allow the mercury, on cooling the apparatus, to rise to a convenient height in the stem. In the stem is a little index similar to those used in Six's thermometer. The stem is divided into millimetres, and was carefully calibrated. If such an instrument be sunk with a sounding-line it is clear that the water will be compressed and that the mercury with the index will rise, such rise being the sum of the decrease in temperature plus the increase of pressure. If a thermometer properly protected be sunk at the same time the temperature will be registered, and thus the increase of pressure can be found. Before starting it was thought that a gauge similar to those used with hydraulic pumps might be employed to determine the pressure, but on examination the gauge furnished was found unreliable, and after all the length of the sounding-line furnished the best gauge of the pressure, provided that care was taken that no currents, bad weather, &c., interfered with the result. If there is a current its existence is always rendered evident by the behaviour of the sounding-line as it goes up and down; so that practically there is no difficulty in saying when a sounding is good. The Lecturer experienced some difficulty with the springs of the indices, and it was only on his way home between Tahiti and Valparaiso, in a depth of 2000 to 2500 fathoms, that he was able to get satisfactory results as to the compressibility of water. As a mean the compressibility of distilled water per 100 fathoms was found to be 0·0009, or, per atmosphere, 0·000049; Regnault finding 0·0000486. The results at various depths agreed well; thus, at 1000 fs., 0·00008; at 2000 fs., 0·0009; at 3000 fs., 0·0008. The compressibility of sea-water was determined in precisely the same instrument, and was found to be, at 800 fs., 0·00077; at 1000 fs., 0·00078; at 1500 fs., 0·00073 per 100 fathoms. These experiments were all made by attaching the piezometer to the sounding-line, the temperature being from 1° to 3° C. In order to determine the compressibility at higher temperatures recourse was had to a hydraulic instrument; but as no reliable gauge was at hand the only results possible were comparative, between sea-water and distilled water. At 26·5° C. (distilled water = 100), 93·6; 25·8°, 92·0; 22·1°, 92·8; 22·5°, 92·0; 13·7°, 92·6. A solution containing 4 per cent sodium chloride gave results:— (Distilled water = 100) 26·5°, 90·51; 25·8°, 88·13; 22·1°, 86·61; 13·7°, 86·84. The compressibility of mercury was next determined and found to be, per 100 fathoms, 0·0000271; per atmosphere, 0·0000015.

The apparent compressibilities of water and mercury having been thus determined, the next task was the practical one of applying the results to control the soundings as obtained by the line, and the temperatures as indicated by the thermometer. Two piezometers, one charged with water the other with mercury, were sent down on the sounding-line. Now water is very sensitive to changes of pressure, but not to changes of temperature. Mercury, on the other hand, is less affected by changes of pressure, but considerably more by variations in temperature. The true temperature and true depth were obtained from the readings of the two instruments thus:—The rough depth, as given by the sounding-line, is applied to correct the temperature as indicated by the mercury piezometer. By this temperature the reading of the water instrument is corrected, and thus the correct depth is obtained to within 25 fathoms. This is again applied to the mercurial instrument, and so, by correcting backwards and forwards, both the correct depth and the correct temperature are found. For great depths the piezometer above described is useless, a pressure above 3000 fathoms forcing the mercury into the bulb. To obviate this difficulty a bulb was blown in the middle of the stem, and its size was so arranged that the contraction up to 1500 fathoms was covered by this

bulb, and so the stem was left to indicate greater pressures. The lecturer had endeavoured to measure the compressibility of glass, but for want of accurate measuring apparatus good results had not yet been obtained. The apparatus consists of a glass tube, in which is a glass rod slightly shorter than the tube: an index is brought down on to the rod. When exposed to pressure the glass tube contracts; the rod, however, maintains its length, and as a consequence the index is pushed up, and thus the amount of contraction is determined.

The Lecturer then described the apparatus by means of which the amounts of oxygen and nitrogen in sea-water were estimated. About 900 to 1000 c.c. were used. The sample was collected in a brass cylinder furnished with stop-cocks having a $\frac{3}{4}$-inch bore, and was transferred to the flask in which it was to be boiled with as little disturbance as possible. To the flask is fitted an india-rubber cork, through which a glass tube, having a large bulb attached to it, passes. The tube and bulb are filled with distilled water, the end of the tube in the flask being closed by a simple device. The bulb is now boiled for ten minutes, and the upper end of the tube closed. The lower end is now connected with the water in the flask, and the latter boiled for one and a half to two hours. The gases evolved are collected in the bulb and analysed. The carbonic acid was determined by distilling about $\frac{1}{4}$ litre of water to dryness after the addition of 15 c.c. of barium chloride solution to prevent bumping. The steam was passed through a still, and the distillate with evolved gases collected in flasks and U-tubes containing standard baryta-water. This, by titration with hydrochloric acid, rosolic acid being used as an indicator, gave the amount of carbonic acid. The following are the results of the analyses of about one-third of the gas samples obtained:—Oxygen + nitrogen = 100. In surface-water O=33·67; at 25 fathoms, 33·4; 50 fs., 32·3; 100 fs., 30·2; 200 fs., 23·4; 300 fs., 11·4; 400 fs., 15·5; 800 fs., 22·6; below 800 fs., 23·5. So that, from the surface downwards, the oxygen decreases to 300 fathoms, below this depth it increases in amount. This increase is in all probability due to the decreasing amount of animal life at depths greater than 300 fathoms. Experiments with the tow-net at various depths confirmed this view. As regards superficial distribution, the cold water at the Antarctic regions, both at the surface and below, is thoroughly aërated, the gases diminishing in quantity as we approach the Equator, increasing again as we proceed northwards. From many experiments it was found that the absorption of nitrogen by sea-water varies considerably from that by distilled water, especially at high temperatures. The lecturer then pointed out the distribution of sea-water as regards density in depth and superficially with the aid of several diagrams. Two regions of maximum density exist, north and south of the Equator. The north maximum being 25° N. of the Equator, the south about 15° S., towards the Equator the density at the surface falls off, whilst towards the Arctic and Antarctic regions the density decreases rapidly. These regions of maxima correspond to the regions frequented by the trade winds. It is known that the South trade blows much nearer the Equator than the North, and so the maximum of density is nearer the Equator on the South. As to vertical distribution the maximum penetrates some depth, but at 350 fathoms a great tract of water of low density is found. At the Equator we find, first, an increase as we go down, then a decrease, and last of all again an increase of density near the bottom. The densest water is found in the Atlantic. In the Pacific a certain imitation of the areas of dense water just described is found. Near ice very light water is found; again, near Hong Kong, just after the monsoons, the superficial water is very light, but during the dry season the water becomes more dense. The maxima of density lie in the North Hemisphere to the S.W., in the South to the N.W., of the maxima of barometric pressure. It is at these latter spots that the cold dry winds descend from great altitudes, and flow outwards, taking up moisture from the sea in their course, and not becoming saturated until they are near the Equator.

The President said that the very best thanks of the Society were due to Mr. Buchanan for the very careful lecture just delivered. He had invited them first into his small but compact laboratory, and explained the ingenious methods for determining various physical questions. He had then detailed the more distinctly chemical results, of great interest, as to the distribution of gases, and especially as to the diminution of oxygen, above and below 300 fathoms, with respect to which he would like to ask whether this always held good for 300 fathoms whatever the total depth might be?

Mr. W. L. Carpenter had listened with great interest to the lecture, especially as he had performed the same sort of work on board H.M.S. *Porcupine*. His laboratory was much smaller, the naturalist and himself having a table only 4 feet square between them. He was glad to hear that Mr. Buchanan's extended experience confirmed in several respects the results which he had arrived at. He would like to ask why the carbonic acid had been separately determined? whether an increase in the quantity of oxygen had been observed during rough weather in the surface water? whether any effervescence had been seen in water brought up from great depths? and whether any chlorine estimations had been made in relation with the specific gravity determinations.

Mr. Warington asked if any determinations of ammonia and nitric acid had been carried out, with reference to the theory that the trade winds came to our shores rich in ammonia, while our soils lost nitric acid to the rivers, &c.?

Mr. Buchanan replied that the depth of 300 fathoms was irrespective of the total depth; that the carbonic acid was determined separately because it had been shown that it could not be satisfactorily driven out of sea-water by boiling *in vacuo*. In one case of cold water, brought up near the River La Plata, he had seen effervescence resembling that of natural Seltzer water; but from want of time he had not made any number of chlorine, nitric acid, or ammonia determinations.

A hearty and unanimous vote of thanks was then given to Mr. Buchanan for his interesting lecture, and the Society adjourned to March 7th.

EDINBURGH UNIVERSITY CHEMICAL SOCIETY

Fifth Meeting, February 20, 1878.

John Gibson, Ph.D., F.R.S.E., in the Chair.

Mr. W. L. Goodwin read a paper "*On a Method of Removal of Iron from Cupric Sulphate for Analytical Purposes*," in which he stated that this could be done by the replacement of the iron by cupric hydrate.

Mr. Alexander Macfarlane, M.A., B.Sc., read a paper "*On the Disruptive Discharge of Electricity*," in which he gave the difference of potential necessary to produce sparks at different distances, and also with different pressures, and gases as dielectrics.

PHILOSOPHICAL SOCIETY OF GLASGOW.

Chemical Section.

January 14, 1878.

Professor John Ferguson, M.A., President, in the Chair.

After the confirmation of the minutes, a paper was read "*On Bishop's Improved Process of Regenerating the Lime used in the Purification of Coal-gas*, by Mr. John Mayer, F.C.S., Secretary of the Section. The author said that he had for many years taken a great deal of interest in the chemistry of gas purification, and the secondary or

waste products of the gas manufacture, and that during the last few months the process about to be spoken of had impressed itself on his mind as one which was a great step in advance, inasmuch as its use bade fair to be attended with a large amount of economy, and to diminish very considerably the nuisance which seemed invariably to result when "fouled" gas-lime was permitted to remain about a gas-works, and more especially when it was being removed as a so-called "waste-product." Almost from the very birth of the gas-making industry the basic alkaline earth, lime, had been used in the purification of gas. For a considerable period, down even to within the recollection of some of those then present, the purifying material was used in the form of a thick milk of lime, in cast-iron tanks; but though the operation was very successful, from a chemical point of view, it was attended with mechanical difficulties that were of so serious a character—in addition to the difficulty of so disposing of the very fœtid waste lime liquor as not to create a nuisance—that it was eventually superseded by the use of dry lime purifiers, the slaked lime being laid on trays or grids in covered chambers or tanks, and allowed to remain exposed to the contact of the gas in its passage from the retorts, where it was generated, to the gasholder, where it was stored. Until within the last eighteen or twenty years, caustic or hydrated lime reigned almost supreme as the purifying agent; but when it was experimentally demonstrated that hydrated peroxide of iron might be used with great effect in removing the impurities from coal-gas, it began to establish its claims and its popularity over lime in many of the large gas-works throughout the kingdom, and especially in those of the Metropolis. One of its chief advantages was that it did not, by exposure in the open air, become a nuisance in the same degree as spent lime did; and another was, that it could be used over and over again. But it was found that, by itself, it was not sufficient for the removal of all the impurities, and some gas managers got into the practice of using it in admixture with slaked lime and sawdust, while others considered it preferable to use the lime and oxide of iron in separate purifiers, which was the plan now generally had recourse to where the last-named compound was employed as a purifying agent. In small gas-works, however, it might be said that lime was almost exclusively used in the purification of the gas, which was also the case in many works of pretty considerable size. Such a process, therefore, as that to be briefly noticed in the paper might well aim at becoming very general, if it could only be satisfactorily shown that it was a success—chemically, mechanically, and commercially.

Before enlarging upon the process, the author noticed briefly what were the impurities which it was desired to remove from the gas. He next spoke of the nature of spent or fouled lime. He then quoted several analyses of spent lime at some length, and said that the product in question was of a very variable composition, owing partly to its freshness, partly to the length of time during which it had been exposed to the action of the gas in the purifiers, and to other causes. There was no doubt, he remarked, that by allowing the spent lime to weather in the open air it would, in course of time, consist largely of sulphate of lime, in consequence of the slow oxidation of the sulphide and other easily transformed calcium compounds. After referring to certain very suggestive remarks of Mr. Lewis T. Wright, on the chemical action which takes place in a dry lime purifier, the author proceeded to say that, as to the very complex composition of "fouled" gas-lime there could be no doubt whatever; but how to turn the substance to account profitably, and reduce the nuisance connected with it to a minimum, was a question that had occupied the attention of many gas-managers and chemists. Certainly the most successful worker in that field of practical investigation up to the present time, so far as he was aware, was Mr. George R. Hislop, F.C.S., the well known manager of the Paisley Corporation Gas Works. That gentleman had attacked the problem of regenerating or revivifying spent gas-lime some years ago. He took some large blocks, and calcined them with coke in the usual way, and the results were upon the whole very successful. The great difficulty, however, was how to re-calcine the smaller portions of the lime, and, in order to get over that difficulty, he had a quantity of gas-lime passed through a pan-mill, in which the lime was broken down, in order to give it a suitable consistency, and fitted for being easily moulded into bricks, which were introduced into a kiln in the usual way. So far the process satisfied him. The bricks were well formed, and in a way that they could be handled and placed in the kiln. But he was not entirely satisfied with the process, as it was impossible, under ordinary circumstances, to make sure that the lime in the centre of the bricks was completely re-calcined or revivified, and he eventually came to the conclusion that the spent lime must be recalcined in as fine a state of division as possible. His experiments gradually led him to devise a furnace or kiln of special construction for the purpose, and with it he had now been working on a practical scale for many months. Indeed, he had informed the author that the lime which he was using in the purification process at his works was that which he obtained by calcining raw limestone in the ordinary way about a year ago, and that he had now entirely discarded raw limestone, whereas he formerly used 800 to 1000 tons of that material per annum.

The author said that he had seen the lime-generating process in operation several times at the Paisley Gas Works; he had also seen it in operation at the Greenock Corporation Gas Works; and in the hands both of Mr. Hislop and Mr. Samuel Stewart it seemed to work exceedingly well, and to be, indeed, a very marked success. Proceeding to describe the process, he said the kiln consists of a series of four calcining chambers arranged vertically over each other, and, together with the furnace underneath them, occupying the space of one of the ovens of the retort-bench. They are about 9 feet long and 2 feet 6 inches wide. The uppermost, which is the drying-chamber, has a capacity fully equal to the united capacity of the other three, which are the calcining-chambers proper, and are each about 9½ inches high. All the chambers are constructed of fire-clay tiles and blocks of similar form. The gases from the furnace pass to the further end of the same, where, by means of two ports at the corners, they pass into the lowermost calcining chamber over the top of, and in close contact with, the spent lime to the fore end of the same; thence up through two ports as before, traversing the second chamber in the same way; then the third chamber; and, lastly, the topmost or drying chamber, from which they enter the main flue, the entrance to which is regulated by a suitable damper. The spent lime is first charged into the drying-chamber by means of a shovel, and it remains in that chamber during the regeneration of the contents of the chambers underneath; and after the latter have been discharged into an iron waggon or barrow, the contents of the upper chamber are discharged into the lower chambers through a port near to the front of each, the opening of which is covered with a suitable tile, as the chambers are successively filled, commencing at the lowermost, and the gases from the furnace, while passing over, and in close contact with, the spent lime, disengage the carbonic acid and other impurities. Air is admitted through ventilating flue-boxes, placed on either side of the furnace near to the ground, whence it is conveyed to, and directed against, the fuel in the furnace near to the centre of the furnace-bars, where it issues from a number of holes, about 1½ inches in diameter, pierced through fire-clay blocks, which form part of the sides of the furnace. These air holes pass through the blocks with a dip of about 1½ inches towards the furnace-bars. In practice it is found that one man can attend to two sets of chambers such as those just described, and regenerate upwards of 50 cwts. of spent lime per shift of twelve hours, with a consumption of about 8 cwts. of fuel, which is usually the coke of ordinary cannel coal.

Mr. Mayer remarked that, so far as the drying and re-calcining of the spent lime were concerned, the operations which he had seen at Paisley and Greenock were practically the same; but he had learned from Mr. Hislop that he was making arrangements for carrying out another part of his process, and which, indeed, he had seen in progress. When oxide of iron, he said, was employed along with lime in the purification of the gas, the last-named compound was produced chiefly in the state of carbonate, and was therefore ready for recalcination immediately that the purifier containing it was thrown out of use; and, according to Mr. Hislop, it might be fouled and revivified for an indefinite number of times, say a hundred, more or less. But when no oxide of iron was employed, the lime produced was largely charged with sulphur, as well as carbonic acid and other impurities; and while that lime might be restored from fifteen to twenty times, or more, before becoming exhausted by its combination with sulphur, forming sulphate of lime, that gentleman had provided in his process that—in order to render the lime more durable and "go on for ever"—the waste gases from the retort furnaces, boiler furnaces, or the calcining chambers themselves, consisting chiefly of carbonic acid, should be drawn off by an exhauster or pump, and forced up through the spent lime, after being shut off from the gas as fouled in the purifier. His intention was to connect the chimney, or main flue, with the purifiers, by means of cast-iron pipes laid in a cold-water condenser. By that arrangement the carbonic acid from the sources referred to would, on being passed through the sulphuretted lime in the purifier, displace the sulphur chiefly in the form of sulphuretted hydrogen, and combine with the lime to form lime carbonate. The discharged gases from the fouled purifier would then be passed through oxide of iron in an adjoining purifier, the residual gaseous matter being allowed to pass into the open air or into a chimney, and the oxide of iron, after absorbing all the sulphurous impurities, as in gas purification, being removed and exposed to the air for revivification in the usual manner, and the carbonated lime transferred to the calcining chambers, and restored to the condition of quicklime as before.

In concluding, the author regretted that, owing to the short time at his disposal for preparing the paper, there had been no opportunity for getting analyses made of gas lime which had been a number of times fouled and re-calcined, so as to see if there was any material and gradual increase in the amount of sulphate of lime. On that point, however, he had been informed that there seemed to be no diminution in the purifying power of re-calcined gas lime. In other respects the paper had been incomplete; but he was glad to see Mr. Hislop and Mr. Stewart present, both of whom would doubtless be willing to supplement his remarks from their own practical experience of the process.

A discussion then took place.

Mr. J. J. COLEMAN, F.C.S., said that it would be essential to the financial success of the process that all sulphur compounds should be removed from the gas prior to the latter being brought into contact with the lime, otherwise there would, he thought, be a progressive deterioration of the lime each time it was re-calcined. He considered that this would practically be very difficult to manage. If the lime were deteriorated only to the extent of 10 per cent at each re-burning, by accumulation of sulphates or sulphides,—a not unreasonable possibility,—then by the end of the fifth re-calcination the cost of re-burning would exceed that of fresh lime. The removal of sulphur from coal-gas by ferric oxide, and its recovery from the oxide by conversion into sulphurous acid in the vitriol chamber furnace, or its recovery in the free state by the process of Pelouze (now in operation in London),—namely, by solution in hot coal-tar naphtha and subsequent crystallisation,—were operations of great interest, and likely to have an important influence in rendering us independent of foreign sources of supply.

Mr. SAMUEL STEWART (Greenock) remarked that he had been using the process, and burning the spent lime, for about two months, during which time he had re-burnt about 100 tons of the lime, or, in other words, about double that quantity of spent lime, for the latter lost nearly half its weight in the process of revivifying. He had found no difficulty or mystery in re-calcining the spent lime. The re-calcining chambers at the Greenock Gas-Works occupied the place of an ordinary oven of retorts in the retort-bench, and they were worked at six-hour charges, producing something like 45 cwts. of re-burnt lime per twenty-four hours. The lime was found to stand in the purifiers equally well with, and also about the same time as, the "shell" lime, even after being re-calcined several times. He said, however, that he only used lime to remove the carbonic acid from the gas, the sulphuretted hydrogen being removed by means of bog iron-ore. The spent lime, therefore, contained very little sulphur. Speaking of the "life" of the chamber, he said that he estimated that it would be equal to the production of from 800 to 1000 tons of re-burnt lime; and he calculated the expense of renewing the chamber at from £40 to £50, or about 1s. per ton of re-burnt lime. He found that the cost of labour and fuel did not exceed 9s. per ton, or, adding 1s. for renewal, say 10s. per ton, or about one-half the cost of new "shell" lime. Not having had an opportunity of getting either the spent or re-burnt lime analysed, he was unable to say if all the impurities were driven off by the re-burning.

Dr. WALLACE, Gas Examiner (Glasgow), remarked that if any sulphur compounds remained in the spent lime, the burnt lime would contain sulphate, He had found that when limestone containing pyrites was calcined, the product retained fully half of the sulphur in the form of sulphate. The value of the process would, therefore, depend very much upon the extent to which the sulphur compounds were got rid of before calcination. Again, the utility of the invention would depend upon local circumstances. In London, for example, the process would be invaluable; and in places where the spent lime could not be disposed of advantageously it would undoubtedly be profitable. But in such towns as Glasgow, where the waste lime was readily sold, it became simply a question of cost whether it would be better to revivify the spent lime or use fresh material every time. The price got for spent lime in Glasgow was from 1s. 6d. to 2s. 6d. per ton, which was equal to from 3s. to 5s. of the cost of the original lime, and that amount added to 9s. as the probable cost of revivifying, came pretty close upon the value of burnt Irish lime—that was to say, about 16s., all charges included.

Mr. G. R. HISLOP (Paisley) said that, not being a member of the Society, he had attended, on the invitation of Mr. Mayer, simply as a listener to what might be said on the subject discussed in the paper. He expected that had Mr. Mayer's paper come on a week or two later, he would have been in a better position to state important facts in connection with the subject, and to have been able to submit analyses of the lime at the different stages of the process, and after several re-burnings; but he was only then engaged in perfecting the desulphuretting part of the process. Undoubtedly it was of great importance to have the last vestige of the sulphur discharged from the fouled lime before re-calcining it, and this he proposed to do by means of the carbonic acid produced in the gas-retort furnaces, sufficiently cooled and passed up through the lime in the purifiers, so soon as they were turned off as fouled. In that way the carbonic acid gas, passing through the myriads of channels formed in the lime, would very speedily discharge the sulphuretted hydrogen, which in its turn would be passed into the oxide of iron. The simple acetate of lead test would indicate when the whole of the sulphuretted hydrogen had been expelled. By that part of the process the valuable sulphur, which had been largely, and in most cases, thrown away as waste, would be recovered. It was by no means a small quantity of

sulphur that was allowed to go to waste; for, after allowing for what might be removed by the scrubbers and washers, it would amount to from 10 lbs. to 13 lbs. per ton of coal carbonised. That was a point not to be lost sight of. Mr. Stewart, who, like himself, purified his gas partly by oxide of iron, intended, in the meantime, to burn his lime with what little sulphur it might contain, and, with regard to the number of times it might be recalcined, he (Mr. Hislop) might state that, of the 60 or 70 tons of lime which he had had in use at the Paisley Gas-Works for the past twelve months, a portion which had been fouled forty-five times (and in several instances made specially foul for the purpose of experiment) contained only 22½ per cent of sulphate of lime. Then as to the value of the spent lime, as ordinarily produced,—like Mr. Stewart, he had always had considerable difficulty in getting it disposed of. Not unfrequently, at least in midwinter, he had sold it at from 4d. to 10d. per ton. But, even supposing that 1s. 6d. per ton could be got for the spent lime, as Dr. Wallace had stated, and that it required nearly 2 tons of spent lime to produce 1 ton of quicklime, Mr. Hislop found that well nigh—if not even fully—this sum would be saved in the preparation alone of the reburned lime, which required no riddling or screening, inasmuch as it contained no stones, and altogether it was much more speedily prepared for use. Speaking of the cost of producing quicklime direct from the raw stone, he said that, before resorting to the regular use of his vivifying process, he had produced all the lime required at the Paisley Gas-Works from Irish limestone, and he quite agreed with Dr. Wallace on the question of first cost. The material could not be produced for less than the amount mentioned—namely 16s. per ton.

The President then summed up the discussion in a few remarks, and, in proposing the thanks of the Section to Mr. Mayer for his interesting paper, he expressed a hope that another paper on the subject would be brought forward at a future meeting, in which the desired analytical results would be embodied.

CORRESPONDENCE.

THE INSTITUTE OF CHEMISTRY.

To the Editor of the Chemical News.

Sir,—So many of my friends in the Institute of Chemistry are under the impression that the "Chemists and Druggists" have done their utmost to oppose the formation of the Institute, that it seems to be almost the duty of one so closely connected with both bodies as I am, without speaking either officially or officiously, to deny that any such antagonism existed or exists, and to assert that pharmacists as a body are entirely in sympathy with the objects of the Institute. Only a fortnight ago a prominent member of the Council of the Pharmaceutical Society wrote as follows in the *Pharmaceutical Journal*:—"To suppose that we could object to a society formed by such distinguished men, and for such high purposes, seems so unreasonable that I need scarcely say a word on that point." No doubt there was, apparently, some temporary opposition to the Institute by the Pharmaceutical Council, but it was exerted not so much in pharmaceutical as in imperial interests, and even that action, for it really was not opposition, was elicited by the initiatory action of the Privy Council, moved by the Board of Trade, in sending on to Bloomsbury the "Articles" for perusal. Some of the objections which seemed to me, when I heard them read by the President of the Institute, to betray legal rather than pharmaceutical leanings vanished on closer investigation. Then the objection to the name "Institute of Professional Chemists" the President of the Institute himself admitted to be fair; for, said he at the recent Annual Meeting, "pharmaceutical chemists might with great propriety, term themselves professional chemists; hence, perhaps it was unwise to take that title without limitation." We must remember that at that early stage of organisation of the Institute pharmacists had no guarantee that persons should not acquire the designation "Professional Chemist" by means inferior to those by which the title "Pharmaceutical Chemist" is acquired, and then forsaking the chemistry they never intended exclusively to follow, foist themselves on the public as qualified pharmacists in defiance of the Pharmacy Act, and under a name not likely to be distinguished by the mass of the public from that of "Pharmaceutical Chemist." We now know that the Institute would not be likely to admit such men. I may parenthetically observe, however, that I cannot see how men of that sort would have been kept out had the Institute been started by public announcements, as some desired, instead of by the present quiet and wonderfully successful mode; a method which, notwithstanding the honoured names it has secured, one gentleman has so far forgotten himself as to term "hole and corner." I agree with the Pharmaceutical Councillor already cited in thinking that the Institute ought to thank the Pharmaceutical Society for having saved it from so loose a title. Imagine this shopkeeping "Professional Chemist" exhibiting, in a gilt frame in his window, a grand diploma, which the real professional chemist would never have occasion to use, and the deception will be seen to be complete; while the objection by the pharmacist on his own behalf and on behalf of the public to the granting of such certificates by the Institute will be seen, I think, to be reasonable. At all events the Organising Committee of the Institute seemed to think so, for they altered the name and at once gave up the idea of issuing a diploma; thus quite meeting the not very formidable objections of the pharmaceutical body. Beyond these objections there has really been no opposition whatever, and the net results of even these may be viewed as the mere clearing away of obstacles to the firm foundation of the Institute.

As regards the first part of the title, "Chemist and Druggist," for it has been a real title since 1868, there does at the present time seem to be a little anomaly in giving the name "Chemist" to the men who study chemistry in an inferior degree and legally (though, by the way, not practically) withholding it from the men who study chemistry in a superior degree. That is not the fault of the pharmacist however. Previous to 1868 any petty huckster could, and often did, term himself or practise as a "Chemist and Druggist," or "Chemist," or "Druggist." The authors of the Pharmacy Act, 1868, simply obtained protection for those designations already long in common use. At all events, not a single follower of chemistry seems to have considered himself sufficiently aggrieved to protest against any such restriction of the name "Chemist;" and that being so, is it astonishing that followers of pharmacy should not have been prophetic enough to see that objections to the name might some day arise? Besides, as regards this name "Chemist," the superiority of claim to it now possessed by those who practise chemistry only, has grown up long since the time when the druggist was the only chemist and the only man then having any good claim to be specially termed chemist. For when, in the seventeenth century, artificial mineral, or inorganic, substances came to be used as medicines, their preparation, quite beyond the power of the collector or herbalist, or the seller of drugs—the grocer and druggrocer, hence, afterwards, drug-gist—was undertaken, or rather grew to be, the province of men who (with some physicians) were the connecting links of the alchemy of the fifteenth century with the chemistry of the nineteenth century. Giving up, as a class, the search for the elixir of life and the philosopher's stone, they became as a class the chemists and the only chemists. The "Grocer and Druggist" gradually dissociated, the druggist and the chemist working for a common end gradually associated, and hence arose the "Chemist and Druggist." The "Chemist and Druggist"

of to-day, therefore, has something even more tangible than priority of claim to the name of "Chemist." He might indeed, though he does not, complain that although as much a chemist as ever his name should be sought to be taken from him by men already bearing the far richer designations of chemical philosopher and chemical analyst, and this at a time when he has arranged that everyone of his class should know something of this same chemical philosophy and chemical analysis. Of the two classes of so-called chemists who now gain their living as chemists, the "Chemist and Druggist" is just able to say that he reckons his age by hundreds of years, while his namesake, better chemist though he be, only reckons his by tens—for though some of the substances we term chemicals have been known for centuries, chemistry as a science is not a hundred years old. We may regret that followers of chemistry are not exclusively called chemists, and followers of pharmacy pharmacists. But we must take things as they are. It is useless kicking against the pricks. Besides, confusions of this kind generally clear themselves away in course of time.

No. Opposition to the Institute of Chemistry will not, I think, be found in pharmacy, nor, apparently, outside the ranks of chemistry at all; and inside there seems to be none worth mentioning. What may be the number of educational, analytical, manufacturing, or other chemists in Great Britain and Ireland qualified to enter such an Institute no one knows. And what number of men there are, qualified as chemists, and indeed already invited to join the Institute, but who may not be following chemistry as a remunerative profession, and who for that reason may not accept election, no one quite knows. But that within six months of the incorporation of the Institute some 300 men, including all the best practising chemists, should enter its ranks, contributing some £1600 to its exchequer, appears to me to show success most marvellous. Of course, among chemists a Paraffin or two are to be expected, although I trust that sooner or later that name will become entirely, as it already is partially, a misnomer. But while such a body, as the Institute seeks to become, can doubtless progress more harmoniously without than with such men, perfect success depends on the entire, or practically entire, co-operation of the chemists of the whole country. Only by such thorough union can we thoroughly promote the interests of the public, the interests of our calling, and, as a consequence, the interests of ourselves. Such results seem really to be in a fair way of being accomplished, and the utmost credit is due to our President and the Organising Committee. I cannot conceive that any drawing together of the chemists of the country in public meetings, or any other mode of initiating action, could have had such very satisfactory results. Here, at all events, is one successful combination of chemists for the common weal. It is too much to expect that a better or more hopeful combination can ever be brought about. I trust that every chemist in the country who has not already joined will send in his adhesion, and that we shall all maintain the Institute with the utmost dignity and ability we possess: maintain it as an Institution created and continued for the welfare of science and the well-being of the kingdom at large.—I am, &c.,

JOHN ATTFIELD.

Ashlands, Watford.

AMMONIA IN FILTERED WATER.

To the Editor of the Chemical News.

SIR,—Your correspondent M. Gustav Bischoff (CHEM. NEWS, vol. xxxvii., p. 79) seems to utterly ignore the very plainly written statements contained in my letter to your paper of January 4th. I stated that the original water was *almost free from nitrates and albumenoid ammonia*, and could only account for the presence of so great a quantity as 7·3 parts per million in the same water, after filtration through a spongy iron filter, by the well-known fact that metallic iron will contribute to the formation of ammonia by oxidation.

Of course I took every precaution to ascertain from my client the full particulars respecting the situation of the filter, and made many suggestions as to the source of contamination.

The spongy iron filter was placed in a large hall, and far away from a water-closet, gas-burners, or drain.

If ammonia can be formed *at all* by the action of iron upon water and air, surely it is open to credence that 7·30 grains could be formed in one million grains of water. The filter referred to had been in use six weeks.

Of course one could scarcely understand how ammonia could possibly be *formed* in ferruginous earth.—I am, &c.,

GEORGE JONES.

106, Leadenhall Street,
February 25, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwis expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 3, January 21, 1878.

This issue contains merely the discourses pronounced by members of the Academy at the funerals of M. Becquerel and M. Regnault.

No. 4, January 28, 1878.

This number gives an account of the various prizes awarded by the Academy.

Justus Liebig's Annalen der Chemie,
Band 190, Heft 3.

Communications from the University Laboratory of Wurzburg.—These communications consist of a paper on the "Splitting-up of Acetic-Ester and its Alkyl Substitution-Products by Bases," by J. Wislicenus; a dissertation, by F. W. Homann, on "Quercite, a Pentacid Alcohol;" a paper, by Leonhard Limpach, on the "Oxidation-Products of Stearolic Acid;" an essay on "Methyl-isomyl Carbinol and Isobutyl Acet-Ester," by W. Rohn; and one by G. Michle, on the "Synthesis of Tricarballylic Acid by Natracetic-Ester."

On Various Amylens and Amylic Alcohols.—A. Wischnegradsky.—The author draws the following conclusions concerning the nature of the amylic alcohol of fermentation and its derivative amylens:—The ordinary amylic alcohol of fermentation, which has generally been regarded as isobutyl carbinol, is probably a mixture of three primary amylic alcohols,—isobutyl carbinol, methyl-ethyl-carbin carbinol (to which the optical action is due), and normal amylic alcohol. Commercial amylen, as prepared by the action of zinc chloride, is probably a mixture of three isomeric C_5H_{10},—trimethyl ethylen, unsymmetri-methyl-ethyl ethylen, and normal propyl ethylen. Ordinary amylen has been taken for isopropyl ethylen, a variety scarcely, if at all, present therein.

Action of Ammonia upon Isatin.—Dr. Erwin v Sommaruga.—For the preparation of isatin in quantity, in which the author encountered at first no little difficulty he recommends the following process:—50 grms. of indigo, reduced when dry to a very fine powder, are stirred up with cold water to a very thin paste, heated to a boil in capacious flasks or capsules, and a concentrated solution of 30 grms. of chromic acid is added in small quantities at a time. As much frothing takes place at the

beginning of the oxidation, the chromic acid must be added with caution, to prevent loss; but as soon as from one-half to two-thirds of the chromic acid have been consumed the remainder may be added more rapidly. When all the chromic acid has been added, the liquid is kept at a boil until the froth, which was at first fine, sinks together, and in its place large bubbles appear on the surface of the liquid. The entire process of oxidation may be completed in ten minutes. The boiling liquid is poured upon a fine linen filter, and gives a filtrate of a fine brownish red colour. On cooling, isatin is abundantly deposited in crystals, contaminated merely with a little brown resin. The chromic hydrate remaining on the filter retains so much isatin that it must be twice or thrice extracted with boiling water. The impure isatin was purified by solution in cold dilute potassa, fractionated precipitation with muriatic acid, and final crystallisation from alcohol. The yield did not exceed 16 to 18 per cent of the indigo employed. The author has examined the action of ammonia upon isatin at strong pressure, when different results appear from those obtained by Laurent in open vessels. Three substances are produced, two of which are genetically connected, whilst the third owes its origin to a separate reaction. No by-products appeared, with the exception of a trace of a beautiful colour, which the author has hitherto not succeeded in isolating.

Moniteur Scientifique Quesneville.
February, 1878.

The papers, chiefly on colouring matters, placed under the head "Foreign Researches," are taken from the *Berichte der Deut. Chem. Gesell*,, and noticed elsewhere.

Memoir on Ultramarines.—Emile Guimet.—Already noticed.

Metallurgy of Nickel.—M. Badoureau.—The author mentions the chief nickel mines and works in Europe. The treatment of the sulphuretted and arsenical ores comprises three processes:—Concentration of the ore by a series of roastings and fusions, and formation of a matte or speiss; transformation of this matte or speiss into oxide of nickel and oxide of cobalt, either in the dry or the wet way; and, lastly, the reduction of the nickel oxide, and silicatisation of the oxide of cobalt. The treatment of the silicated ores of New Caledonia is treated of in a separate chapter.

Analysis of Wines.—From this paper, which does not bear the name of any author, it appears that the quantity of the substances present in a litre of wine may vary as follows:—

Solids	13·0 grms.	to	24·0 grms.	
Sugar	0·6	,,	1·1	,,
Acetic acid	0·3	,,	0·6	,,
Tartaric acid	3·8	,,	4·6	,,
Ash	1·3	,,	2·7	,,
Alcohol in 100 grms...	67·0	,,	88·0	,,

Bulletin de la Société d'Encouragement pour l'Industrie Nationale.
No. 49, January, 1878.

This issue contains no chemical matter except what has been obtained from English sources.

Reimann's Färber Zeitung,
No. 5, 1878.

This issue contains nothing of general interest.

No. 6, 1878.

In a paper read by Dr. F. Fol at a meeting of the Dyers' Association at Berlin it was maintained that the quercitron used in dyeing is not bark but wood. Neither the president nor any of the dyers, &c., present had ever heard this view put forward, and further light upon the subject was demanded.

Bulletin de la Societe Chimique de Paris,
No. 2, January 20, 1877.

Reply to M. E. Guimet.—J. F. Plicque.—The author maintains that from a merely scientific point of view, the idea of substituting selenium and tellurium for sulphur is his own.

NOTES AND QUERIES.

Analysis of Oil-Cake.—I shall feel obliged if anyone can inform me where I can find any account of the analysis of oil-cake.—A. P. S.

Arsenic in Pyrites.—I shall feel obliged if any of your correspondents can inform me which is the best way to estimate correctly the small quantity of arsenic contained in pyrites, or refer me to some book or memoir where a good practical method is described?—Constant Reader.

Prevention of Hydrophobia.—Immediately a person is bitten open the wound with a lancet or other sharp instrument; wash with hot water, then well brush and bathe the place with a very strong solution of bichromate of potash: do not cover the wound, but let it be exposed to the air as much as possible. In a few days the place will commence to ulcerate into (in all probability) a round sore, which will cake over with a scab: this will in time come out, and the place will close with new flesh. Keep the bowels well regulated. I have found this treatment most effectual for the bites of dogs, and for staying the course of ulcers, &c., on the human body.—J. H. Swindells.

Colouration of Water.—I am connected with the Stourbridge Canal Co., on the banks of which are what are called Tin Works, *i.e.*, first iron is rolled in the sheet, and afterwards put into sulphuric acid to pickle, so as to be fit to be coated with tin. The water used from the canal comes into it again, and turns the water to a yellowish or rusty colour: this we want to prevent if possible. We want the water to be returned in such a state that the water in the canal will be free from its present colour. We do not want to annoy the owner of the works. Can you inform me how we can neutralise the iron tinge? Can we put a filter-bed, and in the bed put any chemical, &c., that will have the effect desired?—F. G. H.

MEETINGS FOR THE WEEK.

Monday, 4th.—Medical, 8.30. (Anniversary).
—— Society of Arts, 8. "The Application of Photography to the Production of Printing Surfaces and Pictures in Pigment," T. Bolas, F.C.S.
—— London Institution, 5.
Tuesday 5th.—Civil Engineers, 8.
—— Royal Institution, 3. "Protoplasmic Theory of Life, and its Bearing on Physiology," Professor Garrod.
—— Zoological, 8.30.
Wednesday, 6th.—Society of Arts, 8. "An Electtric Lamp-lighting System, Mr. St. George Lane Fox.
—— Geological 8.
—— Pharmaceutical, 8.30.
Thursday, 7th.—Royal, 8.30.
—— Royal Institution, 3. "Chemistry of the Organic World," Prof. Dewar.
—— London Institution, 7.
—— Chemical, 8. "Action of Ammonia on Anthrapurpurin," Mr. W. H. Perkin. "Some New Derivatives of Anisoil," Mr. W. H. Perkin. "On Certain Poly-iodides," Mr. G. S. Johnson.
Friday 8th.—Royal Institution, 8. Weekly Meeting. "The Influence of Geographical Circumstances on Political Character," Prof. Goldwin Smith, 9.
—— Astronomical, 8.
—— Quekett Club, 8.
Saturday, 2nd.—Royal Institution, 3. "Carthage and the Carthaginians," R. Bosworth Smith, M.A.

TO CORRESPONDENTS.

George Whewell, F.C.S.—The letter from Dr. Attfield in the present issue renders the publication of yours unnecessary.

Just published, price One Shilling,

TELEPHONES, OLD AND NEW.

A Lecture by Professor BARRETT, M.R.I.A.

With Notes and Illustrations.

London: HORATIO YEATES, Optical and Philosophical Instrument Maker, 33, King Street, Covent Garden.

THE CHEMICAL NEWS.

Vol. XXXVII. No. 954.

NEW PRODUCTS OBTAINED FROM COAL-GAS: PONSŒLION, A NEW PIGMENT, AND CYANON, A NEW GUNPOWDER.

By LEWIS THOMPSON.

Although the above substances have been obtained from purified coal-gas it must not be understood that the author of these discoveries has any more serious belief in the mischievous results said to arise from the sulphur in gas than he has in the witches of Hopkins or the Popish Plot of Dr. Titus Oates; on the contrary, he is not without a hope that by the progress of real knowledge the existing disgraceful enactments regarding coal-gas will be sent to keep company with the two comparative illustrations above alluded to, and for the sake of science the sooner this happens the better.

It has been proved that the bisulphuret of carbon, like cyanogen, possesses a power of uniting directly with metals without the intervention of oxygen or any similar body, and hence it has received in that form a distinguishing name, "Erythrogen."

Guided by this property an attempt was made to discover whether erythrogen could displace cyanogen from any of its combinations, and in making this attempt, it was not only discovered that cyanogen can be so displaced, but also that in so doing two hitherto unknown compounds are produced, both of which possess very remarkable qualities. The first experiment was made upon a sample of coal-gas known to contain a rather large proportion of bisulphuret of carbon, and it was conducted thus:—A set of Liebig bulbs were charged with a solution of caustic potash, in which a quantity of bicyanide of mercury had been previously dissolved, and the coal-gas in question was then slowly passed through the bulbs with the following results: in a very few minutes the solution became milky, and this continued to increase for several days, with the deposition of a white precipitate, which, however, by a continuance of the experiment, became first grey, then black, and at last of a beautiful scarlet colour, thus proving the existence of at least two, perhaps three, different compounds. It required a great many experiments to discover the nature of these compounds, and also a sure and certain method of making them uncombined with each other; but at length all difficulties were overcome, and the following process adopted:—Having ascertained by analysis that the scarlet compound derived nothing from the coal-gas but the bisulphuret of carbon contained in it, the gas was abandoned, and pure bisulphuret of carbon employed in its stead in this manner. A strong solution of the cyanide of potassium is to be boiled for several minutes upon binoxide of mercury, or, what answers equally well, the nitric oxide of mercury, sold by apothecaries; it is then to be mixed with three times its bulk of a very strong solution of caustic potash, and when it has become cold it must be cautiously decanted into a Florence flask or other convenient vessel, and a considerable quantity of bisulphuret of carbon added to it with frequent agitation. The mixture assumes in rapid succession a variety of tints, passing from white, yellow, brown, and grey, into black, and if then left to the ordinary temperature of the atmosphere the black is changed into scarlet in the course of twenty-four to forty-eight hours, according to the quantity of caustic potash present, the larger the amount of potash the shorter is the time required for the development of the scarlet colour; but this change is very soon brought about by the employment of heat, and therefore the flask containing the mixture should be placed in a water-bath having the temperature of about 110° F., when in about half an hour the scarlet precipitate will have formed in the flask, and we may distil off and collect the surplus bisulphuret of carbon, after which the pigment must be well washed with hot water and carefully dried. As thus obtained, ponsœlion is a scarlet powder of a very brilliant tint, which differs from that of vermilion so slightly that the two substances are very liable to be confounded with each other, but may easily be distinguished by subliming a little of the powder in a small glass tube, when vermilion will retain its red colour, but ponsœlion sublimes and forms a jet-black mass, frequently containing numerous metallic spangles that strongly resemble metallic antimony and tellurium, although it becomes red when finely powdered. The tint of ponsœlion is, however, not so purple as that of vermilion, and a very eminent portrait painter has pronounced it "the nearest approach to the natural hue of the European countenance" that he has ever met with. We may therefore conclude that it will come into general use as a pigment, and hence its qualities become an interesting subject of inquiry, and it is satisfactory to find that ponsœlion rivals gold itself in respect to resisting the effect of atmosphere influences, for it is unacted on by any one of the concentrated acids, even when boiling hot, and it is only attacked like gold by *aqua regia* and those fluids which generate chlorine; it is, moreover, unaffected by sulphuretted hydrogen, or any of the hydrosulphurets, and as a paint may fairly be said to be imperishable. Its composition appears to be very peculiar, though a sufficient number of analyses has not yet been made to settle that question beyond the range of doubt. Nevertheless, it seems to consist of one atom of mercury (202); three atoms of sulphur (48); one atom of carbon (6); and one atom of hydrogen (1); thus making 257 as its atomic equivalent and leading us to conclude that it is a hydro-erythride of the protosulphuret of mercury, from whence we may infer that it might be made by a very different process to that above described, and, indeed, we may naturally expect many improvements in the mode of its production.

For example, if we regard ponsœlion as a hydro-erythride of the protosulphuret of mercury, we might expect to form it by merely precipitating a mixed solution of the erythride and sulphuret of potassium by a solution of the protonitrate of mercury; but this experiment has not yet been tried, although if successful it would be a very economical mode of making the pigment.

We have seen that the first effect produced by passing coal-gas through an alkaline solution of the bicyanide of mercury is to create a white precipitate, and if we arrest the process at that point we obtain in the usual way of washing and drying, a gray-white powder, which, on the application of heat, explodes with much violence, and requires therefore to be examined with care. It has not yet been analysed, and in all probability consists of two distinct substances; one containing sulphur and the other cyanogen united to some form of hydrocarbon; it is to this last that the name "cyanon" has been provisionally given. As procured in the way described, cyanon is a white powder having a greenish grey tint, and when a few grains of it are heated in a test-tube, it explodes at a heat of about 400° F. with much force, and the production of a considerable quantity of soot or carbon, whilst the mercury is thrown out of the tube to a considerable distance, so that cyanon may truly be said to combine the qualities of both gunpowder and shot. The cyanogen compound, which in cyanon is united to mercury, has been transferred to copper with the production of a copper salt having an explosive quality quite equal to the mercurial compound, and in all likelihood this copper salt is the substance which has frequently caused explosions during the repairing of old gas-meters by soldering them. This explosive quality is, however, destroyed by the action of hydrosulphate of ammonia, and no doubt common gas-

liquor would answer the same end, so that it would be a wise precaution to bathe old gas-meters in gas-liquor before attempting to apply a heated soldering iron to them.

To obtain cyanon it is not necessary that there should be an excess of caustic alkali present in the liquor, for this is needed only to ensure the formation of ponscelion; consequently we have merely to boil a solution of the cyanide of potassium upon an excess of peroxide of mercury, and, after filtering the cold liquor, pass a current of purified coal-gas through it until a sufficient quantity of white precipitate has been formed, which must then be washed and dried in the usual way.

During the above process, as well as in that by which ponscelion is produced, there are formed acids of an unknown kind, part of which remain in the liquor combined with the potash, and it was my intention to carry out the investigation of these things to their complete elucidation, but a domestic calamity has so shaken my health that this is now impossible, and therefore I leave the subject unfinished.

A few words, perhaps, require to be said in explanation of the term "ponscelion." It is derived from the ancient Roman name of Newcastle-upon-Tyne, which was Pons Ælii, and as the substance itself was first obtained out of gas made from Newcastle coals, the name can scarcely be objected to as a mere mark of distinction from vermilion, for which purpose alone it is intended.

February 5, 1878.

ON SOME THALLIUM PIGMENTS.

By THOMAS W. SALTER, F.C.S.

At the International Exhibition of 1871, there was shown a series of thallium colours, made specially by the writer for Messrs. Winsor and Newton, of Rathbone-place. Of these colours, the Chemical News observed:—"Messrs. Winsor and Newton contribute a series of pigments, of extraordinary beauty, prepared from thallium. The specimens include several shades of yellow and orange-red prepared from thallium chromates by the wet way; and green colours, also constituted of thallium and chromium, with a dark brown, a sulphide of thallium."

Previous to the opening of the Exhibition, the following short account of the colours was sent by the writer, on behalf of Messrs. Winsor and Newton, to Professor Abel, F.R.S., Her Majesty's Commissioners' Reporter on Scientific Inventions in relation to Chemistry:—"The range of thallium colours exhibited comprises several shades of yellow, orange, red, brown, and green. The yellow, orange, and red colours are either chromates, bichromates, or terchromates. These were obtained by wet processes, both hot and cold; various precipitants and proportions being employed. Of the two brown colours, the orange-brown, or subdued orange, was prepared by the action of continued heat on the orange bichromate; the other is a sulphide of thallium. The two green colours include a brilliant yellow-green, and a rich olive-green. The former was obtained by partially decomposing the bichromate of thallium with boracic acid; the latter was deposited on adding a mixed solution of a thallium salt and green vitriol to a mixed solution of chromate and red prussiate of potash. By varying the mode of manufacture, thallium colours can be produced bright or subdued, pale or deep, and of different degrees of transparency. At present, the cost of thallium precludes their coming into use as pigments, but it is of importance to the Fine Arts to note all new metals, &c., with a view to testing their fitness for the palette. For the reason stated, the true value of thallium to artists has yet to be ascertained; meanwhile, we have thought the series described would be of interest, as showing the capabilities of thallium, as a source of colour."

To the foregoing may be added Professor Abel's official report:—"The discovery of the metal *thallium*, by Mr. Crookes, through the agency of spectrum analysis, in 1861, created considerable interest at the period of the Exhibition in the following year, when it was first shown in the metallic form by Mr. Crookes. This metal was first discovered in a seleniferous deposit obtained from a sulphuric acid manufactory; it was afterwards found to be very widely distributed, though only in small quantities, in iron and copper pyrites, and also in sulphides of zinc, and was detected in the sulphur, and the copper and zinc obtained from some of these ores. Its properties have since been fully studied, and possess considerable scientific interest; but although somewhat widely disseminated in the mineral kingdom, thallium has hitherto been only found associated in very small proportions with other metals, and there is, therefore, no present prospect of its receiving any useful application. Messrs. Winsor and Newton have indicated one direction, in which the metal, if sufficiently abundant, might be turned to good account, by exhibiting a series of "pigments prepared from thallium." These specimens include several shades of yellow and orange-red, which are thallium chromates, prepared by wet processes, with variations of the nature and proportions of the precipitants employed. There are also some green colours, of which thallium and chromium are constituents, and a dark brown pigment, which is a sulphide of the metal. The value to artists of these and other varieties of pigments which can be furnished by the metal has still to be ascertained."

In his edition of "Field's Chromatography, or Treatise on Colours and Pigments as used by Artists," the writer remarked on thallium colours thus:—

Thallium Yellow.—The new metal, thallium, yields in combination with chromic acid, two yellow colours, a pale and an orange. They are not absolutely insoluble in water, and, the sulphide of thallium being brown, would probably be damaged by impure air. But whatever their properties as pigments may be, their habitudes as such are not yet known. The present scarcity of the metal renders the colours produced from it mere scientific curiosities.

Thallium Red.—The orange-yellow precipitate, formed by mixing a neutral salt of protoxide of thallium with bichromate of potash, is converted by nitric acid into an orange-red. The latter compound, which is a terchromate, is almost insoluble in cold water, 2814 parts being required to dissolve it. If the colour be boiled in a large excess of moderately strong nitric acid, it is dissolved, yielding magnificent cinnabar red crystal on the solution cooling. These crystals, likewise, seem to be the terchromate.

Thallium Orange is produced when bichromate of potash is added to a neutral salt of protoxide of thallium, as an orange-yellow precipitate. The scarcity of the metal precludes their present introduction as pigments, but if the chromates of thallium were found to resist the action of light and air, and not to become green by deoxidation of the chromic acid, they might possibly prove fitted for the palette. It is a question whether their very slight solubility in water would be a fatal objection; and, although they would be liable to suffer from a foul atmosphere, we are inclined to think the effects would not be so lasting as in the chromates of lead. Like lead sulphide, the sulphide of thallium ranges from brown to brownish-black, or grey-black; and, like it too, is subject to oxidation and consequent conversion into colourless sulphate. It is, however, much more readily oxidised than sulphide of lead; and hence the thallium chromates would doubtless soon regain their former hue on exposure to a strong light. Mr. Crookes, who discovered this new metal in 1861, believes that the deep orange shade observable in some specimens of sulphide of cadmium, is due to the presence of thallium. He has frequently found it, he says, in the dark-coloured varieties, and considers the variations of colour in cadmium sulphide to be owing

to traces of thallium. That thallium affects the colour is most probable, but it is not nccessarily the cause of the orange hue. The tint of cadmium sulphide is a mere matter of manufacture, seeing that from the same sample of metal there can be obtained lemon-yellow, pale yellow, deep yellow, orange-yellow, and orange-red. With deference to the opinion of a chemist so distinguished, we hold that thallium rather impairs the beauty of cadmium sulphide than imparts to it an orange shade, the thallium being likewise in the form of sulphide, and therefore more or less black. On chromate of cadmium, made with bichromate of potash, thallium would naturally confer an orange hue.

So far as we know, these observations comprise all or nearly all that has yet been written regarding thallium when viewed solely as a source of material colour or pigment. It is proposed to supplement them with some account of the mode of manufacture of the Exhibition colours at first referred to, as well as with some remarks on their value as pigments.

1. *Lemon Yellow* was prepared by adding a very dilute cold solution of ammoniacal chromate of potash to a very dilute cold solution of nitrate of thallium, the resulting precipitate being rendered still paler by subsequent admixture with alumina. The colour was washed with cold water by decantation, collected on a filter, and carefully dried on a white porous tile exposed to a warm atmosphere. This mode of washing and drying was adopted in all cases. As regards the strength of the thallium solution, from 4 to 6 ozs. of the salt were dissolved in 2 quarts of boiling water, the solutions when cold being further diluted if necessary. In one instance where 8 ozs. were so dissolved, the solution deposited crystals on standing a night.

2. *Pale Yellow.*—Here a hot solution of chromate of potash was added to a cold solution of the thallium. It was found that by adding dilute ammonia to the moist washed precipitate, the pale yellow assumed a lemon tint. When dried, the yellow was not thus changed by the addition of ammonia. This pale variety fell more quickly than the deeper yellow and orange sorts, and formed a less bulky precipitate. In the moist state, it was convertible into deep yellow or orange, by the action of more or less bichromate of potash or very dilute nitric acid.

3. *Middle Yellow* was produced by carefully and gradually adding very dilute ammonia to the orange obtained in 5, until the desired tint was arrived at. A more direct way of preparing the colour is to precipitate the thallium solution with a proper mixture of bichromate and chromate of potash. In the first method, chromate of potash may be used instead of ammonia.

4. *Deep Yellow* resulted on precipitating the thallium nitrate with a mixed solution of 2 parts chromate and 1 part bichromate of potash.

5. *Orange Yellow.*—Formed by adding a mixed solution of equal parts chromate and bichromate of potash.

6. *Orange Red.*—Made by mixing hot solutions of thallium nitrate and bichromate of potash. The orange precipitates are more bulky than the deep yellow, just as the deep yellow are more bulky than the pale and lemon. Moreover, they are less easily washed, taking a longer time to settle, and yield more highly-coloured washings.

7. *Red.*—A boiling mixture of equal parts strong nitric acid and water was added to the washed orange-red precipitate, and the solution suffered to remain a night. The crystalline deposit was then washed with cold water and dried without heat. Unless a large quantity of acid be employed, the orange colour is but partly dissolved, and the hot liquid requires decantation, before being set aside. An inferior red was produced by boiling the orange-yellow, with constant stirring, in a mixture of 75 parts strong acid and 10 parts water.

8. *Orange Brown*, or *Subdued Orange.*—By carefully heating the finely ground orange-red powder over sand, the colour assumed a brown or subdued-orange shade. On so heating a mixture of equal parts of orange-red and pale yellow, a brownish or subdued yellow was obtained. When the orange-red was ignited for some time in a porcelain crucible the powder fused and liquefied, becoming solid on cooling and turning out of the crucible in the form of a highly polished mahogany cone, very weighty and very hard. This yielded on grinding a rich orange-brown powder, of a gritty texture.

9. *Green.*—The yellow chromate of thallium was intimately mixed with three times its weight of boracic acid, and carefully ignited in a clay crucible. A small quantity of boiling water was added to the green mass thus formed, the colour being afterwards washed with cold. By varying the proportions, either a yellow, yellow-green, or blue-green may be produced, according as the chromate is more or less decomposed.

10. *Olive Green.*—A mixed solution of thallium nitrate, with half its weight of green vitrol, was added to a mixed solution of chromate of potash, with half its weight of red prussiate.

11. *Brown.*—This was precipitated from a cold solution of thallium, by somewhat dilute sulphide of ammonium. Another brown is formed when a mixed solution of caustic potash and red prussiate is added to the thallium nitrate.

Without going into minute detail, such is a brief description of the processes employed in the manufacture of the twelve preceding colours or pigments; some of which, it was afterwards found, were merely colours, and not fitted for pigments. A pigment is necessarily a colour, but a colour is not of necessity a pigment. To be a good pigment, a colour must possess certain physical, chemical, and artistic advantages; but, to be a pigment at all, a colour must needs be physically qualified. Wanting in this respect, the following colours must be expunged from our list of thallium pigments:—the red, by reason of its too crystalline nature; and the green, olive green, and orange brown obtained by ignition, owing to a tendency of the yellow contained in them to separate and float on the surface.

As a rule, the stability of a colour is more severely tried in water than in oil, and on this account the former was selected as the trial medium. It may be remembered that, the sulphide being more or less brown or black, the writer conjectured that the chromates "would be liable to suffer from a foul atmosphere." Strange to say, experiment proved this conclusion to be wrong, showing—not for the first time—how liable are theory and practice to clash in the case of colours. A range of water-rubs of thallium chromates, and a water-rub of white lead, were shut up in a room filled with sulphuretted hydrogen gas, with the result that, while the lead was completely blackened, the colour of the chromates was quite unchanged. As regards exposure to light and air:—the *Lemon Yellow* altogether lost its brilliant purity of hue, assuming a blackish-green shade; the *Pale Yellow* similarly suffered to a less extent; the *Middle Yellow* lost its beauty in a still less degree; the *Deep Yellow* became somewhat dull; the *Orange Yellow*, *Orange Red*, and *Orange Brown* were scarcely altered; the *Green* changed from a yellow-green to a blue-green; the *Olive Green* blackened in hue; while the *Brown* became whitish and chalky in the dark portion of the rub, partly disappearing in the middle, and wholly vanishing in the thin wash.

Pure, brilliant, of good body, working well, and entering kindly into admixture, the deep yellow and orange chromates of thallium might fairly lay claim to a place on the palette, but for the presence there of superior and far cheaper pigments of the same class of colour. With the deep yellow and orange cadmium sulphides at hand, however, the introduction of thallium chromates would be superfluous, even if their excessive costliness were not a bar to commercial success.

St. John's Cottage, New Wandsworth, S.W.,
Feb. 15, 1878.

ON THE SOLUTION OF MOLYBDATE OF AMMONIA IN NITRIC ACID.

By SERGIUS KERN, M.E., St. Petersburg.

JUNGCK (*Fresen. Zeits.*, xv., p. 290) remarked that the yellow precipitate, formed in the so-called "molybdic solution," used for the precipitation of phosphoric acid, is due to the action of light on this solution, and is a metameric form of molybdic acid. This precipitate is easily soluble in ammonia, and contains no phosphoric acid. If the molybdic solution is kept in dark green bottles, the yellow precipitate is also formed, but in rather small quantities. On the exposure of the solution to sunlight for some hours, a turbidness is remarked in the liquor, and finally a yellow precipitate falls down. But Uelsmann asserts that even direct sunlight has no action on the molybdic solution (*Fresen. Zeits.*, xvi., p. 52.) Having often remarked the formation of a yellowish precipitate in the bottles used for the molybdic solution, the author also made, some months ago, experiments in this direction.

The molybdic solution was prepared as ordinarily. If the molybdic acid, used for the preparation of ammonia molybdate is free from phosphorus, no yellow precipitate is formed at once or in some hours.

In such pure molybdic solutions, containing no traces of phosphorus, a yellow-white precipitate is remarked, after standing for several weeks, especially if the bottles are often opened. Every opening of the bottle allows a certain quantity of ammonia to fly away. The precipitate is the basic molybdic salt, and not a metameric form of molybdic acid.

The action of light on pure molybdic solution was examined by placing equal quantities of such a solution (50 c.c.) into white and black bottles; the first was then exposed to the action of sunlight.

In one month a notable quantity of the yellowish-white precipitate was found in the two bottles. The white bottle contained, however, a greater quantity of the precipitate. These precipitates contain no phosphorus, and dissolve easily as already remarked in ammonia.

The quantity of this precipitate formed depends much upon the *modus operandi* adopted while preparing the molybdic solution, Eggertz's method being the best.

COLOURED CRYSTALLINE COMPOUNDS OBTAINED FROM BRUCINE.

By DAVID LINDO.

IT has long been known that deoxidising agents, such as protochloride of tin, and sulphide of ammonium, when added to a heated mixture of brucine and nitric acid, give rise to a deep violet colouration. On one occasion having used sulphurous acid as the reducing agent to produce this effect, the tube containing the mixture was left at rest for some hours, when, on examination, it was found that a few violet coloured crystals had subsided. This substance is the nitrate of a blue coloured base, which is very unstable, absorbing oxygen from the air the moment it is liberated from its salts.

There is no difficulty in obtaining the nitrate in considerable quantities. I heat brucine with a moderate quantity of concentrated colourless nitric acid, add a little water, boil until the colour changes to yellow, then add a strong solution of sulphurous acid in excess. A mass of violet coloured crystals, in the form of minute needles, separates as the solution cools. They are thrown on a filter, washed first slightly with water, then with alcohol, and dried on the water-bath. A yellow crystalline compound (the nitrate of another base) is also easily obtained from brucine by the action of nitric acid. It is probable this substance has been already described by Strecker, under the name of Cacotheline. In order to obtain it, I act on brucine with nitric acid, as above, let the mixture cool a little, then add a considerable volume of alcohol. The yellow compound immediately separates in the form of minute crystals. It is washed with alcohol, and dried on the water-bath. These two coloured compounds are readily converted into each other by the addition or abstraction of oxygen.

The violet salt dissolves sparingly in cold, more freely in hot water, to a solution of the same colour. It is insoluble in alcohol. If the aqueous solution is exposed to the air, it gradually absorbs oxygen, and is converted, after some hours, into the yellow compound which remains in solution. Powerful oxidising agents produce this change at once. The addition of sulphuretted hydrogen, sulphide of ammonium, or other deoxidisers restores the violet colour. If sulphurous acid is employed for the purpose it is generally necessary to apply heat. If a small quantity of the violet crystals is placed in a porcelain basin, and treated with a few drops of strong solution of potash or soda, the base is released, and dissolves in the alkali with the production of a magnificent and intense blue colour, which, however, quickly changes to yellow, the two colours mixing produce a beautiful green. The reaction is very delicate. The yellow salt is sparingly soluble in cold water, more freely in hot water. The solution is of a bright amber colour. It is insoluble in alcohol. The addition of sulphuretted hydrogen to the aqueous solution immediately converts it into the violet salt.

Other reducing agents, of course, produce the same result.

Falmouth, Jamaica, Feb. 1, 1878.

APPLICATION OF ORGANIC ACIDS TO THE EXAMINATION OF MINERALS.*

By H. CARRINGTON BOLTON, Ph.D.

(Continued from p. 87).

DECOMPOSITION OF MINERALS BY ORGANIC ACIDS AND OXIDISING AGENTS.

18. DESIROUS of extending the use of organic acids in attacking minerals, we tried the effect of adding oxidising agents to the solution of the acid; the results were satisfactory and prompted the following investigation.

When potassium, sodium, or ammonium nitrate is added to a boiling solution of citric acid, on reaching a certain degree of concentration nitric acid is set free, and this immediately reacts upon the organic acid, decomposing it with evolution of gases. These gases proved on examination to consist of nitric oxide and carbonic anhydride; whether carbonic oxide is present was not determined. The reaction which takes place is very complex; it may possibly be expressed thus:—

$$4H_3C_6H_5O_7+6KNO_3=$$
$$=7H_2O+3K_2HC_6H_5O_7+6CO_2+3N_2O_2$$

or admitting the formation of oxalic acid,† we may write:=

$$11H_3C_6H_5O_7+16KNO_3=$$
$$=8K_2HC_6H_5O_7+3H_2C_2O_4+17H_2O+12CO_2+8N_2O_2$$

Potassium nitrite also decomposes citric acid in a somewhat similar manner, the action beginning in the cold and continuing with violence and a rise of temperature. The reaction may be expressed as follows:—

$$9H_3C_6H_5O_7+16KNO_2=$$
$$=8K_2H.C_6H_5O_7+H_2C_2O_4+3H_2O+8N_2O_2+4CO_2.$$

* Read before the New York Academy of Sciences, April 30, 1877.
† "Watts's Dictionary," i., 996.

Or, abbreviating and disregarding the decomposition of the organic acid, we may have

$$H_3\bar{C}+3KNO_2=K_3\bar{C}+HNO_3+H_2O+N_2O_2.$$

The nitric acid being then in a nascent condition is prepared to effect oxidation in a most powerful manner.

When chlorate of potassium is substituted for the nitrate or nitrite, the decomposition begins on boiling down the solution to small bulk, and proceeds very vigorously, the carbonic anhydride disengaged being accompanied by a gas having an excessively irritating odour and exciting tears. This peculiar substance is probably the same as that obtained in 1847 by Plantamour,* by the action of chlorine on sodium citrate, and which was subsequently studied by Laurent, by Staedler, and by Cloëz.† The latter showed the irritating body to be perchlorinated acetate of methyl, $C_3Cl_6O_2$, and explains its formation as follows :‡

$$H_3C_6H_5O_7+H_2O+16Cl=C_3Cl_6O_2+3CO_2+10HCl.$$

Precisely how the action proceeds with potassium chlorate and citric acid we have not determined; it is undoubtedly more complex than even the following equation indicates :—

$$26KClO_3+27H_3C_6H_5O_7=$$
$$=3C_3Cl_6O_2+45CO_2+45H_2O+8KCl+18KH_2C_6H_5O_7.$$

Tartaric acid behaves exactly like citric acid with the nitrate and the chlorate. Oxalic acid decomposes them in very concentrated solutions and attacks the nitrite very actively, probably in the following manner:

$$2KNO_2+3H_2C_2O_4=2KHC_2O_4+2H_2O+2CO_2+N_2O_2.$$

Acetic and formic acids do not decompose the nitrate nor the nitrite.

19. These interesting reactions enable us to attack many mineral sulphides with the greatest ease. With potassium nitrite and citric acid, they are decomposed in the cold; with the nitrate and chlorate, only on boiling. Pyrites, for example, in fine powder, is very quickly decomposed by these powerful agents, and completely dissolved, save a little sulphur. The solution contains ferric sulphate and hydropotassium citrate, while both nitric oxide and carbonic anhydride are evolved abundantly; the reaction then may be formulated as follows :—

$$4FeS_2+26KNO_3+12H_3C_6H_5O_7=$$
$$=2Fe_2(SO_4)_3+2K_2SO_4+11K_2H.C_6H_5O_7+15H_2O+$$
$$13N_2O_2+6CO_2.$$

Of the eighteen sulphides selected for examination, all but two, molybdenite and cinnabar, are readily decomposed by heating with citric acid and potassium nitrate; stibnite and bournonite yield clear and colourless solutions; argentite and galenite, turbid and colourless solutions; bornite, sphalerite, chalcocite, pyrrhotite, niccolite, smaltite, pyrite, chalcopyrite, ullmannite, marcasite, arsenopyrite, and tetrahedrite give coloured solutions not particularly characteristic. The copper minerals, heated with a large proportion of the organic acid, give precipitates of red oxide of copper. The sulphur in these minerals is not completely oxidised by the potassium nitrate, and a part floats in the solutions.

Parallel experiments with citric acid and potassium chlorate gave similar results, but the action of the chlorate is slower. Tartaric acid may be substituted for citric, and appears to differ little in its solvent power.

20. Although oxalic acid decomposes potassium nitrate, only in the most concentrated solutions, yet the presence of an oxidisable body like pyrites incites a reaction which effects complete decomposition of the sulphide, precisely as with citric acid. Potassium nitrate and oxalic acid heated together give the following reaction :—

$$2KNO_3+5H_2C_2O_4=2KHC_2O_4+4H_2O+N_2O_2+6CO_2;$$

and on the addition of pyrites we have :

$$2FeS_2+12KNO_3+13H_2C_2O_4=$$
$$=Fe_2(SO_4)_3+K_2SO_4+8H_2O+10KHC_2O_4$$
$$+6N_2O_2+6CO_2.$$

Since, however, the nitric oxide is evidently evolved in much greater proportion than the carbonic anhydride, the following equation probably expresses the actual reaction with greater accuracy :—

$$6FeS_2+32KNO_3+29H_2C_2O_4=$$
$$=3Fe_2(SO_4)_3+3K_2SO_4+26KHC_2O_4+16H_2O$$
$$+16N_2O_2+6CO_2.$$

To decompose sulphides with oxalic acid and potassium nitrate, the best results are secured by boiling the two reagents together for a short time, and then adding the finely pulverized mineral; a violent action sets in immediately. In studying the *rationale* of the above-named decompositions, we discovered that many sulphides are attacked by an aqueous solution of potassium nitrate (and nitrite) without the addition of acid; this unexpected result explains satisfactorily the violence of the decomposition of the sulphides by the mixture of reagents, many forces being simultaneously brought into play; the organic acid, while able to decompose the potassium nitrate alone, acts at the same time as a solvent of the products resulting from the decomposition of the sulphide by the nitrate.

This explains also the fact that the comparatively weak acids—malic, acetic, and formic—which do not of themselves decompose potassium nitrate, are able to dissolve the sulphides in the presence of the latter reagents. We are now investigating the behaviour of certain minerals with these and other saline solutions, and hope to present the results in a future paper.

We have applied this method of attack to several other classes of minerals, but without much advantage. The oxides of iron, magnetite, and hematite, as well as franklinite and chromite, resist the combined action of the mixed reagents. The decomposition of silicates is not notably facilitated. Limonite is feebly attacked. Uraninite, however, dissolves completely and rapidly in this mixture of reagents.

The remarkable solvent power of a mixture of nitrate of potassium and citric acid is further demonstrated by the fact that metallic copper, silver, lead, tin, bismuth, and antimony, as well as magnesium, iron, and zinc, dissolve therein with more or less rapidity.

Aluminium resists this mixture of reagents:—the alchemists' dream of an *alcahest*, or universal solvent, is therefore only partly realiscd.

(To be continued.)

* Berzelius, *Jahresbericht*, vol. xxvi. p. 428.

† *Annales de Chimie et de Physique*, (3) xvii, 297 and 311 Cf. "Watts's Dictionary," i 996.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

March 2, 1878.

Professor W. G. Adams, President, in the Chair.

The following candidates were elected Members of the Society:—Mr. J. P. Kirkman and Dr. W. J. Russell, F.R.S.

Mr. Sedley Taylor exhibited the colours produced in thin films by sonorous vibrations. A piece of thin brass perforated with a triangular, circular, or rectangular aperture, and bearing a thin film of soap solution, was placed horizontally on one end of an L-shaped tube: the beam of the electric lamp, after reflection from it, was received on a screen. It was shown that, when a sound is emitted in the neighbourhood of the open end of the tube, the film takes up a regular form, which is indicated by the different colours of the reflected light, and each note has its own particular colour figure; and, further, with different instruments we have different figures. Thus, when a square film was

employed, a kind of coloured grating was the result, which was modified by changing the note, and with a circular film concentric rings traversed by two bars at right angles were observed.

Mr. W. H. PREECE exhibited and described the Phonograph. After referring to the manner in which the preceding communication bore on the subject of the telephone, he went on to explain the construction of the two instruments exhibited, which have been made in accordance with the published accounts of the apparatus and details received from the inventor, M. T. A. Edison, by Mr. Pidgeon and Mr. Stroh respectively. In the first of these the receiving and emitting discs are distinct, the former being of ferrotype-iron and the latter of paper, whereas in the second form of apparatus both these functions are performed by one and the same disk of iron. They also differ in that in Mr. Pidgeon's apparatus the drum receives its motion by hand, and in that of Mr. Stroh a descending weight is caused to communicate motion by a suitable train of wheels, which motion can be controlled and regulated by an adjustable pair of vanes. In both cases the drum is of brass, traced over by a spiral groove, and the whole is mounted on a screw of the same pitch. The manner of using the phonograph is extremely simple. The drum having been covered with tin-foil, a uniform movement of rotation is given to it, and a fine metal point, firmly fixed to the centre of the receiving-plate, is brought in contact with it, care being taken to place the point accurately over the groove. If now this plate be sung or spoken to, the tin-foil will be indented in accordance with the vibrations communicated to the plate. The emitting-plate having been provided with a resonator, its point is now brought into the position initially occupied by the point of the receiving-plate, and, on rotating the drum with the same velocity, fairly identical sounds are given out. It will be seen that Mr. Stroh's apparatus has an advantage over that of Mr. Pidgeon in that it secures a constant rate of rotation; but, on the other hand, the sounds emitted by the paper disk appeared to be more distinct than those from the iron. A number of experiments were performed with the instruments. The sounds were reproduced at times with remarkable distinctness, and when Mr. Spagnoletti and Mr. Sedley Taylor sang "God Save the Queen" as a duet through a double mouthpiece, the two voices could be clearly distinguished on its being reproduced. It was shown that even when an indented sheet of tin-foil has been employed to emit sounds, it retains its form with such perfectness that the sounds can be reproduced by means of it a second and even a third time with nearly equal distinctness.

Prof. GRAHAM BELL pointed out that the articulation of the instruments was very similar to what he had observed in the earlier forms of the telephone, and he had no doubt, judging from his own experience of that instrument, that the phonograph will ere long be so adjusted as to articulate much more perfectly. He anticipated that the *quality* of the sound would be found to vary as the rate of rotation was altered, as well as the pitch, and this proved on experiment to be the case.

EDINBURGH UNIVERSITY CHEMICAL SOCIETY.

Sixth Meeting, February 27, 1878.

W. INGLIS CLARK, B.Sc., in the Chair.

A PAPER was read on *Electrolysis*, by R. M. MORRISON, D.Sc., Chemical Demonstrator of the University, in which he traced the history of *Electrolysis* down to the present time, showing that in 1840 the art was practically in its infancy, and that at the present day it was in numberless ways made use of. The chief points of theoretical and practical interest were dwelt upon, both with regard to the various metals which could practically be used, and to the solvents form which the best results were attainable.

NOTICES OF BOOKS.

The London Water Supply, being a Report submitted to the Society of Medical Officers of Health on the Quality and Quantity of the Water supplied to the Metropolis during the past Ten Years. By C. M. TIDY, M.B., M.S., &c. London: J. and A. Churchill.

IN this report the author considers the important question "Is the present water-supply of London pure and wholesome?" and answers it in the affirmative. He points out, in our opinion very justly, that the purely chemical point of view must here be regarded as merely subsidiary to the medical. He remarks that "The Kent Company's water, although reported to be loaded with 'previous sewage contamination,' is undoubtedly of excellent quality; nevertheless, although I have most diligently considered and compared the death-rates, and also, as far as possible, the causes of death of different parts of the metropolis supplied by the Thames water, the Lea water, and the water from the chalk-wells of the Kent Company respectively, I have failed to discover any difference worth noting in the death-rates, or any evidence whatsoever that any special class of disease has been prevalent from drinking the waters of the Thames and Lea, or absent from the use of the chalk-water. Indeed, what differences exist are in favour of the Thames and Lea waters, over that of the chalk-wells."

Dr. Tidy quotes, from the "Sixth Report of the Rivers' Pollution Commission" (p. 275, three lines from bottom), a passage which he says "we may well be amazed to read." The Commissioners say—"The supply of such water (*i.e.*, the Kent Company's) to the metropolis generally would be a priceless boon, and *would at once confer upon it absolute immunity from epidemics of cholera.*" On this he very appositely remarks—"If there had been one medical man upon the Board such words would never have been written. We who know how little is known of the cause of such epidemics, how they come amongst us even when we think our defences most secure, how little able we are to cope with them when they are in our midst, may fairly stand aghast when those who are outside our profession, and have never had to fight the battles we have had to fight with disease, have been rash enough to commit such words as these to paper. The members of that Commission, laying claim, as it would seem, almost to prophetic power, or at any rate to a knowledge positively superhuman, have drawn what I may venture to designate as a very violent conclusion."

Dr. Tidy has laid his finger on the fundamental error in the original constitution of the Commission. We should have naturally expected that an inquiry into a chemical question, with its bearings upon public health would have been entrusted to a joint commission of chemists and physicians. On the contrary, it comprehended only one chemist, and no medical man. The part played by engineers in sanitary questions is strictly analogous to that which devolves upon the cutler and the potter in the preparation of our food.

The processes used by Dr. Tidy in the analysis of his samples of water may require some little notice. He records his adherence to the permanganate process, "every year's experience only confirming its accuracy as a qualitative test." Of the Frankland-Armstrong process the experience of the last two years compels him to speak more favourably than on previous occasions. In the "albumenoid ammonia process" as a test of purity his faith is very small. He adds that "the results obtained by the permanganate and by the combustion processes closely agree, whereas the results obtained by Mr. Wanklyn's process seldom correspond, and are often at direct variance with both the permanganate and the combustion processes." We may here remark that we scarcely see how the results of a process like the "permanganate," which professes to indicate the gross amount of organic

matter in a lump, and which is further acted upon by certain inorganic matters, can be said either to agree with or to vary from the results of another which aims at determining the nitrogen only. The permanganate of potassa at ordinary temperatures and in dilute solution has very little action upon living organic matter, which is considered the most dangerous impurity. We have seen "moving organisms" retain their activity for many hours in water to which a large excess of permanganate had been added, and should therefore expect that they would escape immediate oxidation, and consequently fail to tell upon the result. Dr. Tidy's opinion, based as it is upon wide and prolonged experience in conjunction with the late lamented Dr. Letheby, is, however, entitled to great weight, and it must be admitted that the inorganic impurities which sometimes vitiate the results of the permanganate process are certain not to occur in the London waters.

Whilst holding that the supply of water to a great city is not a task that can safely be entrusted to private enterprise, freed from the salutary check of competition and invested with a perpetual monopoly, we gladly record our opinion that the work before us is a valuable and thoroughly practical contribution to English sanitary literature.

CORRESPONDENCE.

ILLUMINATING POWER OF BENZOL, &c.

To the Editor of the Chemical News.

Sir,—What I meant to criticise in my former letter was Dr. Frankland's verbal communication to the Chemical Society, as reported in the Chemical News of Jan. 28. At the time when I wrote it was perhaps a little rash of me to simply assume that the reporter substantially reproduced what the Doctor said, but since then that report has been fully confirmed by Dr. Gerstl in his letter to the *Berichte der Deut. Chem. Gesell.*, and, besides, Dr. Frankland does not impugn its correctness. Hence I now feel assured that his report is correct, and, more especially, that the sentence which I quoted between inverted commas does reproduce the very words of the speaker. With the memoir which Dr. Frankland is going to *print* I can have nothing to do. If in it he means to substitute "hydrocarbons which combine with sulphuric acid" for the words "*benzol, ethylene, propylene, butylene, and acetylene,*" which he used at the meeting, why it only proves that Dr. Frankland does not care to re-assert before the whole of the scientific world what he has already asserted before the Chemical Society.

Dr. Frankland says that he collected bags full of marsh-gas from a marsh near Manchester, and showed the non-luminosity of fish-tail flames fed with it to a large audience at the Royal Institution. To this my "inner consciousness" adds that, at the same lecture, the Doctor showed the combustion of a piece of phosphorus in oxygen. Does it follow that he was the first to observe the brilliant luminosity of burning phosphorus? But really, it is scarcely worth while now to enquire who it was that first observed that a fish-tail consuming marsh-gas is almost non-luminous, since I have proved that even ethylene—*as a constituent of ordinary coal-gas*—is "non-luminous" in the same sense (though of course not in the same degree) as marsh-gas.

Is there any need of my specially affirming that I never suspected Bunsen or any other chemist of being *ignorant* of the presence of benzol in coal-gas? According to *my* knowledge of English, "*ignoring*" a thing does not mean to be "*ignorant*" of it; and all I said of Bunsen was that (in his method of coal-gas analysis) he "*ignored*" the presence of benzol, and did not even find it worth reporting as being included in the "C_2H_4" and "C_4H_8;' for the very same reasons as those that caused Dr. Frankland (in his analyses of 1852) to simply determine the carbon vapour present in forms absorbable by vitriol, without discriminating between benzol-carbon and olefine-carbon.

It is quite true that somewhere in my paper I say "There *is* room for a little benzol." But these words, as every body sees, are used only as formulating the result of a re-calculation of part of the coal-gas analysis which Bunsen gives in his "Gasometrishe Methoden." It also is true that I *did* express in my paper a doubt as to whether coal-gas, as used by the consumer, can possibly contain more than a minute fraction of the benzol which was present in it when it left the retort. But this is not, as Dr. Frankland insinuates, a "*vague impression*," but a legitimate conclusion from experiments which *proved* that benzolated hydrogen, when kept over water, soon loses the better part of its luminosity (and accordingly of its benzol), and from my analysis of the bromides which I had extracted from Glasgow gas, and which turned out to consist, *substantially*, of $C_2H_4Br_2$ mixed with a little of the next higher homologues.

If, notwithstanding these results, I pronounce it "highly probable that the light-value of a coal-gas depends far more on the proportion of benzol" (small as it is) "than on the proportion of olefines which it contains," this "vague impression," again, is founded upon experiments which proved that, for equal quantities of carbon-vapour per unit-volume of gas, benzol is infinitely more luminous than etyhlene. What good would it have done if I had determined, photometrically, the exact ratio of the luminosities of the two flames, and calculated it to so and so many decimal places? Probably, in Dr. Frankland's eyes, this would have turned the "vague impressions" into a piece of "exact science." In my mind exact science is nothing more nor less than correct observations and close logical reasoning founded upon these and upon established propositions.—I am, &c.

W. Dittmar.

Anderson's College,
February 19, 1878.

CHEMISTS AND CHEMISTS.

To the Editor of the Chemical News.

Sir,—For myself, I have no doubt as to the accuracy of the statements made by my friend Professor Attfield, or why should he have asserted them so confidently; and that it now only remains for some ingenious historian to show that the designations of poet, painter, &c., pertain primarily to dealers in other people's poetry and paintings. Still, the conclusion being thus remarkable, would Professor Attfield, out of consideration for those perverse persons who will not accept statements on authority, however eminent, kindly give your readers the dates and references on which he relies, concerning the earliest recorded use of the word "chemist," as applied distinctively to the worker in chemicals, in substitution of the older word alchemist; and as applied distinctively to the dealer, or retailer, or dispenser of chemicals in association with the word "druggist"—of course, "distinctively" to satisfy doubters of the distinctive priority of the druggist's claim. His letter need not be long or elaborate—just a reference to the passages, &c., he had in his mind will, I am sure, carry conviction, —I am, &c.,

A Credulous Chemist.

London, March 5, 1878.

Royal Institution of Great Britain.—At the general monthly meeting of the above Institution, held on Monday last, the special thanks of the members were given to Warren De la Rue, Esq., D.C.L., for his donation of fifty pounds for the benefit of the Chemical Laboratory.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwis expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 5, February 4, 1878.

New Observations on the Chemical Reactions of the Electric Effluve and upon Persulphuric Acid.—M. Berthelot.—Persulphuric acid being formed in the reaction of sulphurous acid upon oxygen it was natural to think that the same compound might be obtained directly by means of anhydrous sulphuric acid, and the supposition has been verified by experiment. Having introduced into an effluve tube 277 milligrms. of anhydrous sulphuric acid contained in a phial tube, the author closed the tube, filled it with dry oxygen (about 60 c.c.) and caused the effluve to act upon it at high tension for eight hours. The bottom of the tube was then heated to disperse certain small opaque masses of anhydrous sulphuric acid not yet attacked, and the effluve was again allowed to act upon it for some hours. At the end of this time the sulphuric acid had disappeared, and in its place was a substance having the aspect of persulphuric acid. The volume of gas which had disappeared was rather more than 20 c.c. at 12°. The product obtained was really persulphuric acid, as it yielded to a standard solution of ferrous sulphate a weight of oxygen equal to 26·2 m.gr. or 9·5 per cent in relation to the sulphuric acid, while theory requires 10·0. The author then examined if any reaction takes place between anhydrous sulphuric acid and dry oxygen left in contact in a tube otherwise quite similar for ten days without being submitted to the action of the effluve. The result was negative. The persulphuric acid when prepared does not possess an indefinite stability when the action of the effluve is suspended. After some days the fine crystalline needles obtained at first after a few days are resolved into a sort of attenuated snow, which seems to be a combination of sulphuric and persulphuric acids. A similar substance is produced in the outset when the effluve is allowed to act upon anhydrous sulphuric acid in presence of oxygen, and it may hence be regarded as an intermediate product. It appears therefore that persulphuric acid as well as ozone and oxygenated water undergoes spontaneously a gradual decomposition when the foreign energy, under whose influence it has taken its rise, ceases to act, that is, to communicate to the matter a special condition and a particular kind of movements or vibrations. The formation of persulphuric acid requires a notable excess of oxygen. If merely the quantities indicated by the equivalents are employed the reaction remains incomplete. This circumstance is explained if we remark that the effluve exerts a double action, both decomposing and combining. In general, binary compounds submitted to the action of the effluve are not simply resolved into their elements, but one portion is decomposed whilst another portion forms more complex compounds. Thus sulphuretted hydrogen yields hydrogen, sulphur, and hydrogen polysulphide. Such phenomena of equilibrium between decomposition, pure and simple, and the formation of complex and condensed compounds are not only met with in the study of reactions brought on by the act of electrisation, but they are observed also in reactions induced by the action of heat and of light. The equilibria accompanying such electric, pyrogenic, and photogenic synthesis present one common character: they express the result of two conflicting energies—the chemical energy, which tends to realise among bodies the reactions (combinations, condensations, or sometimes decompositions) capable of liberating the greatest amount of heat, and, on the other hand, the thermic, luminous, or electric energy, which tends to provoke the contrary reactions—those accompanied with absorption of heat.

Definite Hydrates formed by the Hydracids.—M. Berthelot.—The author gives the following as a list of the simplest hydrates:—1. $HCl+H_2O_2$ answers to $S_2O_8H_2+H_2O_2$ crystallised, and perhaps also to the sub-hydrate $KH_2O+H_2O_2$, but it has not been isolated. 2.—$HCl+2H_2O_2$, liquid and crystalline. Its formation liberates in the liquid state +11·6 cal.; in the solid state about 14·1 cal. $HBr+2H_2O_2$, liquid and crystalline. Its formation liberates in the liquid state +14·2. The hydrates containing a proportion of water higher than $2H_2O_2$ are only known in the liquid state, their melting-point being above −35°. 3. $HI+3H_2O_2$. Its formation in the liquid state liberates +15·6 cal. 4. $HBr+4{\cdot}5H_2O_2$, liquid, evolves +17·5. $HI+4{\cdot}5H_2O_2$, liquid, evolves +17·0. 5.—$HCl+6{\cdot}5H_2O_2$, liquid, evolves +14·0.

The Vibrations of Matter and the Waves of the Ether in Phosphorescence and Fluorescence.—M. Favé.—The author ascribes phosphorescence and fluorescence to the vibrations of the phosphorescent or fluorescent body propagating in the ether waves of an intensity sufficient to affect the eye, especially when this organ is for the time being withdrawn from the action of the waves which act habitually upon it.

On the Dark Rays of the Solar Spectrum and the Constitution of the Sun.—A. Cornu.—The position and the relative brightness of the solar spectrum are explained by the action of an absorbent stratum existing upon the sun, a stratum whose composition is analogous to that of volatilised aërolites.

Refraction of Gases and Vapours.—M. Mascart.—The new results obtained by the author are:—

	Refraction with Relation to that of Air.
Chlorine	2·63
Bromine	3·85
Hydrochloric acid	1·52
Hydrobromic ,,	1·95
Hydriodic ,,	3·10
Hydrocyanic ,,	1·49
Sulphhydric ,,	2·12
Ammonia	1·29
Water	0·88
Phosphorus protochloride	5·92
Carbon sulphide	5·05

Repulsion Resulting from Radiation.—W. Crookes.—Presented by M. Th. du Moncel.—For several years I have been pursuing my researches on the repulsive force resulting from radiation transmitted through rarefied gases. The apparatus I used consisted of a torsion balance, in which the beam for carrying the experimental disks is a straw suspended by a very fine glass fibre. Six disks, each differing from each other, are suspended from one end of this beam, and they are balanced at the other end by a suitable counterpoise. A standard candle, placed at a fixed distance from the balance, supplied the radiation, and the displacements produced by this radiation were increased on a graduated scale by a ray of light reflected from a mirror. A screen was so arranged that the light might fall on any disk selected for experiment without the others being affected. Finally, a standard lampblacked disk was placed in the apparatus in order that the results might be compared. All the apparatus was carefully sealed and attached to a mercury pump capable of carrying the exhaustion to any desired point. My experiments have extended over one hundred different substances, and I have measured the effect produced by them, not only under the influence of simple radiation from a luminous source, but also by removing the invisible heat rays by the interposition of a water screen. In this manner I found that each substance exercises a more or less distinct action on the absorption of rays. Thus most white powders powerfully absorb the invisible heat rays, while they are almost without action on the luminous rays.

On the contrary, the black powders powerfully absorb the luminous rays and only slightly absorb the obscure heat rays whatever their intensity may be. The different metals present great differences in their action. Iron, for instance, chiefly absorbs the invisible heat rays, while gold is principally acted on by the luminous rays. The substances I have experimented with may be divided into two classes: 1st. Those whose action is increased by the interposition of water screens with regard to the effect produced on the standard disk; 2nd. Those in which the contrary is the case. Amongst the former may be mentioned copper tungstate, saffranin, precipitated selenium, and copper oxalate; these are more affected by light than by invisible heat. Amongst class 2 may be mentioned chromic oxide, persulphocyanogen, zinc oxide, barium sulphate, and calcium carbonate; these are acted upon more by the ultra-red rays than by the luminous rays. Remarkable effects may be obtained by combining the substances in these two categories on the disk of the radiometer. Thus, if we alternately coat these disks, which we will suppose to be made of pith, with chromic oxide and precipitated selenium, the radiometer will be seen to turn in one direction when it is exposed to the light of a candle, and the contrary way when a water screen is interposed before the luminous source. A similar radiometer, the vanes of which are coated with saffranin and hydrated zinc oxide, does not move at all when it is directly exposed to the flame of a candle, but will be set in motion as soon as a water screen is interposed. In a note which I have had the honour of presenting to the Academy of Sciences I have shown that when the exhaustion of a radiometer is carried beyond a certain limit its sensibility gradually diminishes until it became absolutely null. I have entered more deeply into this question, and have come to the conclusion: 1st. That there is a gradual increase in the sensitiveness of the radiometer until the pressure has attained 50 millionths of an atmosphere (0·038 millim.); 2nd. That beyond this limit to 30 millionths of an atmosphere (0·013 millim.) it remains stationary; 3rd. Further still, it sinks rapidly until at 1 millionth (0·00076 millim.); 4th. That at 0·2 millionth of an atmosphere (0·00015 millim.) the radiometer refuses to turn even when five candles are put near it. To examine the effects of molecular pressure produced directly by heat upon a radiometer I arranged, besides the system of vanes suspended horizontally, a ring of platinum which could be rendered incandescent by an electric current. The vanes were of transparent mica, and were inclined to each other like the sails of a windmill, and above these vanes was a mica disk, which turned on a separate pivot. The normal direction of this disk was naturally inverse to that of the system of vanes. The following are the results I obtained:—(1.) When the apparatus is full of air at the normal pressure of 760 m.m., and the platinum ring was incandescent, the direction of the rotation of the vanes and disk was *positive*, that is to say, that which would be produced by a current of air coming from the platinum ring: this effect must be attributed to the ascending current of hot air. (2.) At a pressure of 80 millims. the disk did not turn. The vanes turned slowly in the positive direction. (3.) At 19 millims. no movement was produced either by the disk or by the vanes. (4.) At 14 millims. the disk remained stationary, but the vanes began to turn gently in the negative direction, that is to say, in a way inverse to their first direction. (5.) At 1 millim. the disk turned in a continuous manner in the positive direction, whilst the vanes turned rather fast in a negative direction. (6.) At 0·224 millim. the speed of the disk or the vanes was the same, and their rotative movement was the same. Below the pressure the speed of the rotation of the vanes diminished gradually, whilst the speed of the disk increased, and at a pressure of 0·107 millim. the disk turned rapidly in the positive direction, whilst the vanes were motionless. (7.) With a more perfect exhaustion still, at 0·098 millim. a sudden change was seen. The vanes which had been stationary then began to turn in the positive direction at a speed of 100 revolutions per minute, whilst the disks turned as before, positively, but with less speed. It is probable that the speed of this disk was diminished in consequence of the rapid movement of the vanes in the opposite direction.* (8.) When the exhaustion was carried beyond 0·098 millim. the speed of the two disks and of the vanes increased till it exceeded 600 revolutions per minute, and it did not seem to diminish with the highest rarefaction, which was at 0·0001 millim. According to the most recent determinations the number of molecules contained in a cubic centimetre of air at the ordinary pressure is probably something like 1,000,000,000,000,000,000,000 (one thonsand trillions); consequently, at an exhaustion of 0·0001 millim., 100,000,000,000,000 are still left. This number is sufficiently large to justify the hypothesis—That when the molecules are set in vibration by a white-hot platinum wire they are still capable of exercising an enormous mechanical effect.

Researches on Accidental Double Refraction.—M. Macé.—The author finds that Wartheim's law is only applicable to ordinary glass compressed regularly or tempered.

New Direct-Vision Spectroscope.—M. Thollon.—The description of this instrument is not capable of abridgment. The author states that it is distinguished by its small bulk, its lightness, and by the ease and precision with which the prisms are handled. Its dispersive power can be rendered equivalent to that of 15 to 20 prisms of 60°. On applying it to the light of the sun he has seen over the whole outline of the disc the brilliant rays of hydrogen and helium with remarkable distinctness.

Densities of Vapour.—L. Troost.—The author finds that the vapour density of acetic acid resumes its theoretical value corresponding to 4 volumes, even at temperatures bordering upon 120° if we operate under feeble pressure. From this observation it results that the excess of the vapour density of acetic acid observed by M. Cahours when near its boiling-point may be explained by a rapid change of the coefficient of expansion of the vapour on the approach of its change of state. The density of the vapour of hyponitric acid likewise at temperatures close upon 22° takes its theoretical value corresponding to 4 vols. on operating under feeble pressure. On the contrary the analogous excess observed in case of sulphur seems explicable by a polymeric condensation of the molecules of the body, according to experiments made under feeble pressure at 360° and 440°.

Dissociation of Barium Carbonate.—M. Isambert.—Barytic carbonate is almost undecomposable by heat alone, though Abich has shown that it can be converted into caustic baryta at the temperature of a forge. If the carbonate is mixed with charcoal the decomposition is easier, a full red heat being sufficient to produce baryta and carbonic oxide. The charcoal maintains around the carbonate an atmospere in which the tension of the carbonic acid is constantly nil, and the decomposition, which only gives rise to a very slight tension of gas, can thus continue indefinitely. The author has verified this hypothesis by heating carbonate of baryta in a current of inert gas, and found decomposition ensue at a red heat.

Solubility of Lime in Water.—A. Lamy.—The solubility of pure lime in water may vary in a permanent or transitory manner with its nature or origin, its state of molecular aggregation, the temperature at which it has been prepared, its dehydration or recalcination at a red heat, the duration of its contact with water, and, lastly the previous heating of the lime-water more or less prolonged. The least soluble lime is that

* I have already explained, in a note laid before the Academy last year, that the friction of the air at an exhaustion of 0·098 millim. is only a little less than that which it shows at a normal pressure of 760 millims., and consequently the vanes, having a speed of 100 revolutions per minute, must exercise a considerable reaction on the contrary rotation of the disks.

prepared from a carbonate precipitated from the pure nitrate with carbonate of ammonia. The most soluble resulted from the calcination of limes of different kinds, the crystalline hydrate, marble, and the nitrate. Crystallised hydrate of lime dissolves only with excessive slowness at temperatures near that of melting ice. The numbers found at 0°, 54°, and at 100° differ very sensibly from those given by Dalton and Phillips.

Researches on the Nature of the Highly Volatile Products contained in Crude Benzines.—MM. C. Vincent and Delachanal.—Independently of the hydrocarbons already pointed out in that portion of the oils of coal which distils before benzin the authors have discovered and characterised common alcohol, cyanide of methyl, and sulphide of carbon. The two latter are in such proportions that it would be commercially advantageous to treat these light products, in order to manufacture acetate of soda and ammonia from the decomposition of the methyl cyanide and to extract the carbon bisulphide.

NOTES AND QUERIES.

Ancient Metallic Iron.—Can any of your readers refer me to any scientific work or paper in which I can find analyses of ancient metal ic iron? I mean of well authenticated specimens belonging to the earliest epochs in which that metal was known.—A. E. A.

Safety Matches.—I have recently found by experiment that the "Special Safety Matches," which profess to *ignite only on the box*, will strike freely on common coal, provided of course both materials be dry. Anyone can verify this for himself, and the chemical reason is simple, viz., the combustible carbon of the coal takes the place of, and acts like, the amorphous phosphorus of the rubber. This fact, I think, will not only prove of general interest, but may also lead to the manufacture of a safety match without the employment of phosphorus, a result which, as observed by Hofmann, "would indeed be a grand achievement."—Bertram A. Muirhead, Lieut. R.N.

MEETINGS FOR THE WEEK.

Monday, 11th.—Medical, 8.30.
—— Royal Geographical, 8.30.
—— Society of Arts, 8. "The Application of Photography to the Production of Printing Surfaces and Pictures in Pigment," T. Bolas, F.C.S.
—— London Institution, 5.
Tuesday 12th.—Civil Engineers, 8.
—— Royal Institution, 3. "Protoplasmic Theory of Life, and its Bearing on Physiology," Professor Garrod.
—— Photographic, 8.
—— Anthropological, 8.
Wednesday, 13th.—Society of Arts, 8. "Further Remarks on Lightning Rods," Dr. R. J. Mann, F.R.A.S.
Thursday, 14th.—Royal, 8.30.
—— Royal Institution, 3. "Chemistry of the Organic World," Prof. Dewar.
—— Royal Society Club, 6.30.
Friday 15th.—Royal Institution, 8. Weekly Meeting. "The Explanation of Certain Acoustical Phenomena," Lord Rayleigh, F.R.S., 9.
—— Society of Arts, 8. (Indian Section). "The Colonisation of Hill Districts in India," Lieut.-General McMurdo, C.B.
Saturday, 16th.—Royal Institution, 3. "Gleanings from the Natural History of the Ancients," Rev. W. Houghton.
Physical, 3. "On the Transmission of Sound through Copper Wires," by Mr. Millar. "On Thermo-Electric Currents in Wires subjected to Mechanical Strain," by G. W. von Tunzelmann.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.
Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.
The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.
Especial facilities or persons preparing for Government and other examinations.
Private Pupils will find every convenience.
Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.
Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal P ly-technic Institution.

TEXT-BOOKS OF SCIENCE.
In small 8vo., with 72 Diagrams and Figures, price 3s. 6d.
INORGANIC CHEMISTRY (Introduction to the Study of). By W. Allen Miller, M.D., late Prof. of Chem King's Coll., London. New Edition, with Questions for Exami nation
London: LONGMANS and CO.

Mr. WATTS'S DICTIONARY OF CHEMISTRY.
Complete in 7 vols., medium 8vo., price £10 16s. 6d.
A DICTIONARY of CHEMISTRY, and the Allied Branches of other Sciences. By Henry Watts, F.R.S., assisted by eminent Scientific and Practical Chemists.
"The greatest work which England has yet produced on chemistry—one of the greatest, indeed, which she has produced upon any scientific subject—is finished at last, and we are able to congratulate Mr. Watts most sincerely upon its completion."—*Chemical News.*
"The English language is not rich in lexicons of science: we would point to this work as a model upon which others might be framed. It certainly exhausts the subject up to the date of publication, and therefore forms as it were the balanced ledger of the chemist."—*Athenæum*
London: LONGMANS and CO.

Chemical Technology, or Chemistry in its Applications to the Arts and Manufactures. By Thomas Richardson and Henry Watts. Second Edition, illustrated ith numerous Wood Engravings.
Vol. I., Parts 1 and 2, price 36s., with more than 400 Illustrations.
Nature and Properties of Fuel: Secondary Products obtained from Fuel: Production of Light: Secondary Products of the Gas Manufacture.
Vol. I., Part 3, price 33s., with more than 300 Illustrations.
Sulphur and its Compounds: Acidimetry: Chlorine and its Bleaching Compounds: Soda, Potash: Alkalimetry: Grease.
Vol. I., Part 4, price 21s., 300 Illustrations.
Aluminium and Sodium: Stannates, Tungstates, Chromates, and Silicates of Potash and Soda: Phosphorus, Borax: Nitre: Gun-Powder: Gun Cotton.
Vol. I., Part 5, price 36s.
Prussiate of Potash: Oxalic, Tartaric, and Citric Acids, and Appen dices containing the latest information, and pecifications relating to the materials described in Parts 3 and 4.
Bailliere and Co., 20, King William Street, Strand.

MILTON CHEMICAL WORKS,
STOKE-ON-TRENT,
STAFFORDSHIRE.
JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.
N.B.—J. H. being a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.
Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays.. ..	£2	2 0
200 Specimens, in Cabinet, with 5 Trays.. ..	5	5 0
300 Specimens, in Cabinet, with 9 Drawers ..	10	10 0
400 Specimens, in Cabinet, with 13 Drawers ..	21	0 0

More extensive Collections at 50 to 5000 Guineas each.

J. I. HEADLY, Engineer, Cambridge, Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

PATENTS. PATENTS.
ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

THE CHEMICAL NEWS.

Vol. XXXVII. No. 955.

ON DYER'S CHEMICALS.

By J. MARZELL.

(Continued from p. 86.)

B. Phenol (Carbolic Acid), C_6H_5OH.

Manufacturing.

We owe the discovery of this body in coal-tar to Runge,* who, however, did not describe its constitution. Laurent† pointed it out to be a phenol-hydrate, and his works about it, as well as his method of producing it on a large scale, created the interest for that body, now produced in enormous quantities and in the state of utmost purity.

Runge treated the whole tar with milk of lime, diluted the formed carbolate of lime in water, filtered, and decomposed with a mineral acid. Afterwards, he distilled the crude carbolic acid, treated the distillate with basic acetate of lead, dried the precipitate, and got pure phenol by re-distilling the same.

Laurent, on the contrary, only took the oils distilling between 150° to 200° C. He treated that part of the "light oils" with a boiling soda solution, digested the basic oils from the precipitate, diluted the carbolate of soda in water, digested from the arising precipitate (basic oils, naphthalin, &c.), and decomposed the clear liquid with sulphuric acid. The oil is taken off, washed with water, dried with chloride of calcium, and then submitted to fractional distillation.

Laurent's acid—fusing at 34° C., and soluble in 33 parts of water—was a long time considered the pure phenol, and regarded as the standard body in the industry. In 1866 Crace-Calvert, however, succeeded—by an improved method—in producing a phenol, soluble in 20 parts of water, fusing at 41° C., and boiling at 182° C.

Laurent's acid, therefore, was impure, and really a body crystallising in large octahedra, and turning out to be carbolic acid + 1 aq. of water (in distilling it with caustic lime a phenol of 41° C. was obtained) could be isolated from an aqueous solution at +4° C.

Though the carbolic acid is heavier than water, only the oils below 1·00 sp. gr. are taken for its separation. Babœuf proposed the treatment of the creosote oils as well, but this process could not be naturalised in industry.

For the extraction of phenol, the "light oils" are taken either after having taken away the "crude naphtha" (up to 140° C.), or as they are received from the tar-still. The principle of separation rests upon the formation of a salt, and isolating the same from the neutral oils.

About the strength of the alkaline solutions to be taken opinions are various. Many manufacturers prefer to take a strong solution of caustic soda (25° to 30° B.), and to heat the oils up slightly with it by means of indirect steam, whilst others only use a solution of 15° to 20° T., and operate at ordinary temperature.

In the first case, iron tanks are taken of about 1000 galls. capacity (*e.g.*, adjusted to a crude naphtha still of about 800 galls. capacity), with a system of steam-pipes lying on the bottom. The oils are put in, warmed up (just lukewarm), and then the solution of NaOH is added, whilst well mixing, even by hand, or, better, by means of a mechanical arrangement.

To ascertain the needed quantity of NaOH, a sample of the respective oils (50 c.c.) are treated with a titrated solution of NaOH till a new addition of soda no longer diminishes the amount of neutral oils floating on the top. The proportions thus found, calculated back to the whole lot of light oils, will give the approximate quantity of soda to be taken.

The mass is allowed to cool down and to settle for some hours (it is best to let it stand over-night). After that the oils are swimming on the surface, whilst the carbolate, &c., of soda is to be found on the bottom as a pasty mass. The oils are drawn off, and have to undergo the usual treatment of distilling; whilst to the remaining mass 6 to 7 times its volume of water are added, and the whole heated up. The soda compounds of phenol and its homologues enter into solution, whilst the insoluble impurities separate, and are removed by digestion. The clear liquid is drawn into a lead-lined tank, and treated with sulphuric acid. The phenol and its homologues coming up to the top as an oil are drawn off into a second lead-lined vessel, and washed two or three times with cold water. This time the oil will settle to the bottom, because it was, indeed, lighter than the solution of sulphate of soda, but now is heavier than the water. The latter, therefore, has to be carried away by means of a syphon. Well mixing is a principal condition, as a quantity of water as small as possible has to be taken, because by the solubility of the carbolic acid a loss cannot be prevented. On the other side the washing has to be done as carefully as possible, because free H_2SO_4 would injure the iron stills. To prevent all losses these wash-waters are put aside and taken afterwards to dilute the caustic soda. The phenol obtained always contains water, which cannot entirely be separated by distilling, and which prevents the pure phenol from crystallising. It is therefore intimately mixed in a wooden tank with melted chloride of calcium, allowed to settle, and drawn off. Another way is to heat the phenol up by indirect steam, and to let pass through it a quick stream of dry air. The resulting dehydrated crude carbolic acid is submitted to fractional distillation. By preference small stills of 150 to 200 galls. capacity are taken, the thermometer plunging into the vapours. The stills are heated up generally with direct fire, but sometimes superheated steam is used. The coils are of lead.

As to the fractional points, they vary considerably. In many works, where the carbolic acid is only brought up to this point, that part above 1·00 sp. gr., and distilling between 176° to 204° C., is understood and sold as "crude carbolic acid." Everything coming over up to 176° C. is put to the light oils for re-distilling, and above 204° C. put to the creosote oils.

If the working up to a chemical pure product is intended the separation has to be closer to the boiling-point of the phenol, and only the part distilling between 186° to 195° C. generally is taken as suitable for the fractional distillation. The parts passing from 176° to 186° C. and from 195° to 204° C. are put aside and re-distilled several times, the quantities obtained here of fraction 186° to 195° C. being joined to the first product. The so-obtained distillate is put into suitable vessels, and submitted to a temperature of 8° to 10° C., which can easily be effected by letting circulate a fluid around the apparatus.

Following Lowe and Gill* (1874), it is best when the mixture of carbolic acid and homologues is capable, when dehydrated, of crystallising between 62° and 95° F. (16·5° to 35° C.). According to them it is better if the mass contains water, so that in a state of dehydration it is advisable to add water equivalent to a proportion of 5 to 30 per cent. About the temperature to cool it down to they recommend to vary between 15° to 50° F. (−9·5° to +10° C.), and propose to surround the crystallising vessels by cooling mixtures.

In these vessels the whole solidifies to a conglomerate of crystals impregnated with the liquid homologues. The crystals are separated in a centrifugal machine from the liquid, pressed, and submitted again to the distillation. Nearly all will pass over between 187° to 189° C. To effect a complete separation from the homologues the dis-

* *Poggendorff's Annalen*, xxxi., 65; xxxii., 328.
† *Ann. der Chem. et de Phys*, [3]. t. iii., p. 95.

* Patent, No. 1435.

tillate is submitted to another re-crystallisation, either by partial fusion or subsequent refrigeration of an aqueous solution by means of employing gradually changing temperatures. By another fractional distillation a pure phenol, answering all tests, will be obtained.

The apparatus used with advantage in the fractional distillation is the same as Girard and De Laire describe for isolating aniline from toluydin.* The refluxing condenser is filled with pure phenol, the vapours rising from the same being condensed in a coil especially for this purpose. The flue of the fire-place beneath the still goes around it, but an arrangement is made allowing to heat it up directly. Often paraffin, or any other heavy oil, is preferred to phenol, which, by its rapid evaporation, always wants much care, but in this case an iron pipe connects the condenser with the chimney to allow the vapours to escape. The still is filled with the mixture of phenol and homologues and heated up. The vapours rise into the refluxing condenser, but as this is cold, they are condensed and fall back into the still. To quicken the operation the refluxing condenser itself is heated up slowly, but the fire taken out as soon as the temperature is of about 170° to 175° C. By the vapours out of the still the bath is now heated up gradually to about 186° to 187° C., where the thermometer shows a constant point. Here the receiver must be changed. After a short time the thermometer begins to rise again, and another receiver is put on.

In the same way cresylol and even higher homologues can be obtained, only other fractions have to be taken to start with.

Emile Kopp† proposed to take for the decomposition of the carbolate of soda the acid and alkaline solutions having been used for the purifying of the first runnings. These liquids have to be mixed in such proportions as to produce a bisulphate of soda holding in solution the alkaloids which were united to the acid (aniline, toluydin, &c.). A heating up takes place, and the phenol separates as an oily mass on the top of the solution, consisting of sulphate of soda and the alkaloids.

In the works the following process is adopted to recover the acid:—Directly from the mixing-tank the wash-acid is drawn into a lead-lined vessel, and there decomposed by water. A black disagreeably-smelling mass separates on the top, is taken off, and the remaining red weak acid taken for the decomposition of the carbolate of soda.

A method to get pure phenol was proposed by H. Müller.‡ The heavy oils are treated with milk of lime, the separated carbolate of lime diluted with water, filtered, and the liquid so obtained exposed to the oxidising influence of the air. A change of surface is hereby of great importance, and therefore the liquid is either filled into large flat vessels, or a stream of air is passed through it, or it is allowed to run in a fine stream between a system of vessels. When the liquid ceases to get darker it is filtered, and by an experiment in the laboratory the acid wanted for the decomposition is ascertained. Advantage is now taken of the difference in stability between the phenol and its homologues. If the acid is added in small quantities, and each time the precipitate separated by filtering, at the last portion of acid phenol is obtained in a state which allows to get a pure body (187° to 188° C.) after a few distillations. The phenol obtained in this way, however, gives an unpleasant smell, which (according to H. Müller) is due partially to sulpho derivatives. The addition of oxide of lead during the oxidation obviates that inconvenience.

Another way to effect this is the following:—The carbolic acid is treated at a temperature of 100° C. with a solution of oxide of lead in caustic soda, the mixture allowed to settle, and digested. After washing with sulphuric acid and digesting, a small quantity of H_2SO_4 is added, and a bichromate of potassium solution of a certain strength supplied gradually. When the oxidising process is finished it is digested, washed, and the remaining purified phenol rectified by distillation.

A. Ott* gives an account of carbolic acid manufacture (in America?), resting upon H. Müller's principles. But he only takes the oils distilling up to 212° C.

H. Schintzler describes† a process intending to get pure phenol by cokeing the impurities or making them insoluble.

Black, so-called carbolate of soda, is heated up in a copper still till the distillate gets milky (the heat is then not above 170° C. in the vapours). Then a quantity of three times its weight of water is added, the clear solution of carbolate of soda digested, and the phenol separated by decomposing with sulphuric acid.

The synthetical method of Wurtz, Kekulé, and Dusart,‡ adjusted to industrious conditions, allows to produce a pure phenol directly from benzol by baking the soda-salt of the benzo-mono-sulpho-acid with caustic soda. To manufacture the benzol-mono-sulpho-acid ($C_6H_5SO_3H$) equal parts of oleum and benzol are mixed at common temperature. Common H_2SO_4, of 1·840 sp. gr., can also be used with advantage, but in this case a slight heat has to be supplied. If all benzol is diluted, three to four times its weight of water is added, digested, and the aqueous solution of sulpho-acid and free sulphuric acid precipitated with caustic lime. The separating $CaSO_4$ is taken away by filtering and the hot solution treated with carbonate of soda till a sample does not show any more precipitate on the addition of a new quantity. The solution of $C_6H_5SO_3Na$ so obtained is evaporated down to a certain concentration, and baked with caustic soda.

According to Ch. Girard (Würtz) pressure-tubes with agitators are very convenient for the soda melt. The best horizontal cylinders are taken, provided with pressure gauge, safety-valve, steam-pipe, man-hole, a pipe for blowing out the melt if finished, a pipe for the thermometer, and two or three cocks at different heights for taking out samples during the operation. The man-hole has not to shut till the reaction begins. Then the fire is moderated, and the agitator put in movement. In this way the formation of secondary products can be prevented partially. The melt is diluted with water in lead-lined tanks, and decomposed with H_2SO_4. The resulting phenol is extracted with ether, digested, the ether evaporated away, and the resulting phenol purified by re-distillation.

Church|| obtained a very pure carbolic acid in diluting about 1lb. of white crystalline phenol in 20 lbs. of cold water, but with the precaution that not all the phenol goes into solution. The liquid is saturated with NaCl, and the phenol got as a yellow oil on the top. In distilling it with caustic lime the resulting anhydrated phenol can be got crystallised.

Examinations.

To examine for carbolic acid a great number of methods have been indicated. An aqueous solution of iron perchloride causes a blue colouring, the more intense the purer the phenol. Also with chloride of lime and ammonia a blue colouring is obtained.

Plugge recommends NO_2 as a very sensitive reagent. Even traces of it colour red with phenol. (Larger quantities of NO_2, however, render the reaction indistinct.) Nitrate of mercury, containing free NO_2, can be taken in preference.

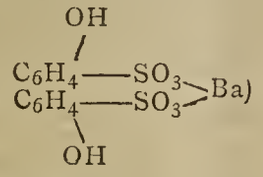
Landolt treats a solution of phenol with bromine-water. The yellowish white precipitate of tribrom-phenol is separated by filtering, and treated by amalgam of sodium, $+H_2O$, and warming up slightly. On addition of sulphuric acid the phenol is separated therefrom as oil.

Schödler proposes to use the formation of mono-phenol-sulpho-acid. 2 or 3 gr. of the respective body are heated upon a water-bath, and the same quantity of sulphuric

* Derivs. de l'Houille, Paris, 1872.
† *Moniteur Scientifique*, 1860, pp. 823, 824. *Zeit. für Analyt. Chem.*, 1865, p. 270.

* *Dingler's Poly. Journ.*, clxxxvii., 946.
† *Ibid.*, ccxiv., 86.
‡ *Bull. de la Soc. Chim.*, viii., 198. Chem. News, No. 620, p. 173.

acid is added gradually. After some time standing at a temperature of 50° to 60° the solution is saturated with $BaCO_3$, filtered, and the filtrate (containing the Ba salt of the phenol-mono-sulpho-acid,—



decomposed with sulphuric acid. The precipitate of $BaSO_4$ is dried, weighed, and calculated back for phenol.

E. Pollacci* has published very interesting researches about the sensibility of some reagents.

Blue colouring with $NH_3+CaOCl_3$	1-3000th part.
Violet, with Fe_2Cl_6	1-2000th ,,
Yellow, with hot NO_3H	1-6000th ,,
Yellow precipitate with Br water ..	1-15500th ,,

For examining crude carbolic acid two methods are used in commerce:—

(1.) To see how much tar-acids—phenol and homologues—there are in a given sample:—Into a graduated cylinder of 100 c.c. 50 c.c. of the mixture are put, and—whilst shaking well at each fresh addition—a solution of caustic soda is applied gradually. In allowing the mixture to settle, the neutral oils gather on the surface, and if a new quantity of soda solution does not diminish them any more it is easy to see how much indifferent oil there is present.

(2.) To fix the crystallising-point of a dehydrated sample:—1000 grs. of the fluid are put into a glass retort and distilled. If 100 c.c. are gone over—only phenol, not water and phenol together—the receiver is changed, and the next 62 per cent, = 620 grs., collected. A crystal of phenol is added, and whilst stirring well with a glass rod or the thermometer, notice is taken of the temperature at which the mass solidifies. This crystallising-point, compared with that of standard products, will give a certain point of examination of the quantity of the sample.

(To be continued).

TESTS OF THE SERVICE OF A DOMESTIC WATER-FILTER.

Communicated by Prof. ALBERT B. PRESCOTT.

To obtain some data as to the efficiency of the filtration of rain and river water, by the portable filters used for household purposes in many parts of the United States, it was proposed to make comparative determinations of waters before and after filtering. The results obtained so far, and here given, are from the work of Messrs. E. M. Reed and Theo. Hauck, done under my direction.

Only the following determinations have been made: (1) The "free ammonia" and "albuminoid ammonia" of the Wanklyn process; (2) the chlorine; and (3) the total residue at 100° C., and again after ignition. The time at disposal was not enough for determinations of the organic carbon and nitrogen in the residue by Frankland's process. In any view of Wanklyn's determinations, their application to a given water, before and after a given operation upon it, must give good data as to the effects of such operation on the nitrogenous organic matter. As a measure of the removal of inorganic solids, the residue by ignition was the chief reliance, though the residue constant at 100° C. was weighed. The loss by ignition is presented as a factor to inquire about. It is well enough known that loss by ignition bears no regular ratio to quantity of organic matter. The chlorine was determined, as evidence of the character of the organic matter, and to see what effect the filter had upon diffusible salts.

The filters used were of a kind in common use for filtering rain-water for potable purposes; the bed being pulverised wood-charcoal with layers of gravel. For Nos. 3 and 5 to 10, a new filter was taken. The bed of this was about 28 inches in depth, and 18 inches in diameter at the top, narrowing a little at the bottom. At the top was a three-inch layer of pebbles, then an eighteen-inch layer of charcoal, mixed with pebbles, then an inch of pebbles, and last, about six inches depth of charcoal, retained at the orifice of the reservoir by wire-cloth. All the charcoal was hard-wood charcoal, "pulverised right to let the water through," the manufacturer said. For No. 1, a smaller filter of the same pattern was used, and after being in daily use about eight months, the filter bed not being filled with water (or excluded from the air) more than one-third of the time. The filter used for No. 2 had been long in service, but had been covered with water only a small portion of the time. For No. 4, the filter used had been in employ two or three months, and constantly covered with water during this time. The water entered the bed at the bottom, and was drawn off at the top.

No. 1 was rain-water from a cistern; No. 2, well-water; No. 3, water from a spring coming out in a cemetery; No. 4, rain-water, it is not known how collected; Nos. 5 to 9, inclusive, rain-water contaminated with urine; No. 10, distilled water, contaminated in the same way.

The samples, No. 3 and 5 to 10 inclusive, were filtered through the new filter (first above described), consecutively in the order of their numbers, with intervals of a few days (and exposure to air) between the filtrations.

Parts of "Free Ammonia" in One Million Parts of Water.

Waters.	Before Filtering.	After Filtering.	Removed by Filtering.
No. 1.	0·50	0·070	0·430 or 86 per cent.
,, 2.	0·08	0·020	0·060 ,, 75 ,,
,, 3.	0·05	0·008	0·042 ,, 84 ,,
,, 4.	1·34	0·140	1·200 ,, 89 ,,
,, 5.	33·00	8·100	24·900 ,, 75 ,,
,, 6.	4·00	0·400	3·600 ,, 90 ,,
,, 7.	2·50	0·080	2·420 ,, 96 ,,
,, 8.	4·06	0·620	3·440 ,, 84 ,,
,, 9.	1·94	0·420	1·520 ,, 78 ,,
,, 10.	1·08	0 180	0·900 ,, 83 ,,
Mean			3·85 or 84 ,,

Parts of "Albuminoid Ammonia" in One Million Parts of Water.

Waters.	Before Filtering.	After Filtering.	Removed by Filtering.
No. 1.	0·30	0·01	0·29 or 96 per cent.
,, 2.	0·14	0·06	0·08 ,, 57 ,,
,, 3.	0·07	0·07	0·00 ,, 0 ,,
,, 4.	1·14	0·57	0·57 ,, 50 ,,
,, 5.	1·90	0·10	1·80 ,, 94 ,,
,, 6.	0·40	0·10	0·30 ,, 75 ,,
,, 7.	0·50	0·03	0·47 ,, 94 ,,
,, 8.	0·38	0·06	0·32 ,, 84 ,,
,, 9.	0·30	0·04	0·26 ,, 86 ,,
,, 10.	0·06	0·01	0·05 ,, 83 ,,
Mean	.. ..		0·41 ,, 72 ,,

Grains of Total Residue left at 100° C. from One Gallon of Water.

Waters.	Before Filtering.	After Filtering.	Removed by Filtering.
No. 1.	24·556	11·265	13·259 or 54 p. ct.
,, 2.	119·274	102·343	16·931 ,, 14 ,,
,, 3.	82·432	81·876	0·556 ,, 1/0 ,,
,, 4.	35·084	30·243	4·841 ,, 13 ,,
,, 5.	222·723	197·226	25·497 ,, 11 ,,
,, 6.	199·952	156·107	43·845 ,, 21 ,,
,, 7.	197·693	141·826	55·867 ,, 28 ,,
,, 8.	181·273	150·194	31·079 ,, 17 ,,
,, 9.	110·963	97·852	13·111 ,, 12 ,,
,, 10.	102·837	89·651	13·186 ,, 13 ,,
Mean			21·817 ,, 18 ,,

Gaz. Chim. Italiana, vi., p. 8.

Grain of Residue after Ignition from One Gallon of Water.

Waters.	Before Filtering.	After Filtering.	Removed by Filtering.
No. 1.	10·526	10·101	0·425 or 4 p. ct.
,, 2.	87·362	85·141	2·221 ,, 2 ,,
,, 3.	33·322	31·926	1·396 ,, 4 ,,
,, 4.	3·508	2·836	0·672 ,, 19 ,,
,, 5.	106·997	76·385	30·612 ,, 29 ,,
,, 6.	73·662	70·263	3·399 ,, 4 ,,
,, 7.	86·915	83·715	3·200 ,, 3 ,,
,, 8.	63·781	59·624	4·157 ,, 6 ,,
,, 9.	64·876	41·937	22·939 ,, 35 ,,
,, 10.	71·139	55·851	15·288 ,, 21 ,,
Mean			8·431 or 13 ,,

Grains of Loss by Ignition of Residue from One Gallon of Water.

Waters.	Before Filtering.	After Filtering.	Difference Due to Filtering.
No. 1.	14·030	1·164	12·866 or 91 p.c. less.
,, 2.	31·912	17·202	14·710 ,, 46 ,, ,,
,, 3.	49·110	49·950	0·840 ,, 2 ,, more.
,, 4.	31·576	27·407	4·169 ,, 13 ,, less.
,, 5.	115·726	120·841	5·115 ,, 4 ,, more.
,, 6.	126·290	85·844	40·446 ,, 32 ,, less.
,, 7.	110·788	58·111	52·677 ,, 47 ,, ,,
,, 8.	117·492	90·570	26·922 ,, 23 ,, ,,
,, 9.	46·087	55·915	9·828 ,, 21 ,, more.
,, 10.	31·698	33·800	2·102 ,, 6 ,, ,,
Mean	.. ..		13·390 ,, 22 ,, less.

Grains of Chlorine in the Chlorides of One Gallon of Water.

Waters.	Before Filtering.	After Filtering.	Removed by Filtration.
No. 1.	None	None	
,, 2.	6·626	6·393	0·233 or 3 per cent.
,, 3.	1·933	1·532	0·401 ,, 21 ,,
,, 4.	None	None	
,, 5.	Trace	,,	
,, 6.	,,	,,	
,, 7.	,,	,,	
,, 8.	,,	,,	
,, 9.	,,	,,	
,, 10.	,,	,,	

The results show that an average of 72 per cent. of the putrescible matter indexed as albuminoid ammonia by the Wanklyn process was removed by filtration. The instance of least removal was the 50 per cent. of No. 4, with use of a filter which had been continuously covered with water, and was doubtless saturated in part with the organic solids. On the other hand, the small filter taken for No. 1, which had been in daily use for eight months, but had been drained off and left to the air for the larger part of the time every day, removed 96 per cent. With Nos. 2 and 3, the quantity found present before filtering was so small that the result of filtration is not conclusive.

The removal of "free ammonia" seems to have averaged 12 per cent. larger, and to have been much more uniform than that of "albuminoid ammonia." The steady removal of so large a proportion of ammonium compounds, by charcoal filters doing daily service for months, is a result of much interest. It is desirable to have farther investigation as to this removal, and especially as to the appearance of nitric acid, from oxidation. It is to be noted that the submerged filter used for No. 4 did not fail to remove ammonia, if the single determination can be relied upon. The evidence is too narrow to prove, as it implies, that dissolved oxygen suffices to oxidise ammonium salts, while atmospheric oxygen is required to oxidise the organic matter yielding ammonia with the permanganate, alkali, and heat, of Wanklyn's process.

The meaning of the results of the determinations of total residue after ignition is not obvious. The quantities of this residue from rain-waters are so large that one is forced to consider the extraction of inorganic salts from the filter-bed. The effect of filtration upon the ignition-loss (the water of hydration and carbon dioxide and organic matter of the residue) seems to vary between 91 per cent. taken away, and 21 per cent. added by the filtration.

University of Michigan,
September 26, 1877.

THE APPLICATION OF SONSTADT'S SOLUTION TO THE SEPARATION OF MINERALS FOR CHEMICAL ANALYSIS.

By EDWARD T. HARDMAN, F.C.S.
Geological Survey of Ireland.

I SEND the following account of what is perhaps the first application of the above liquid to such a purpose.

Professor A. H. Church, in a short article in the *English Mechanic* (vol. xxvi., p. 327), has noted the applicability of Sonstadt's solution to the separation of minerals, but so far as I gather from that paper, it does not appear to have been practically used for analytical purposes. The liquid consists of a solution of iodide of mercury, in iodide of potassium, and is made by adding alternately those salts in a dry state to the solution, until no more of either is dissolved. The free iodine which sometimes colours it is then removed by means of a crystal or two of hydrosulphite of sodium, and the liquid, which possesses a very high density, then presents a light straw colour. Professor Church has obtained it of a density of 3·01, so that a very large number of minerals could be separated, and their density determined directly, by using various strengths of the liquid from the above downwards.

At the time I noticed Mr. Church's article, I had a very difficult problem to solve as to the separation of minerals. A basalt from the North of Ireland contained a peculiar mineral in great abundance, which I had every reason to believe an undescribed one. I wished to get sufficient of it for analysis, but though disseminated throughout the rock in great profuseness as small nodules, it proved a most tedious task to attempt to collect a quantity of it—in fact, after about three weeks hard work with a forceps I only succeeded in obtaining sufficient for a qualitative analysis. As in the course of this it was ascertained that the mineral is of a low specific gravity, it occurred to me that it might be separated by a liquid of high density, and while I was trying for such a liquid Professor Church's note caught my attention. The liquid he recommends succeeded admirably. That which I used had a specific gravity of only 2·40, which was more than sufficient for my purpose, as the specific gravity of the mineral in question subsequently proved to be only 1·70. The method of separation I adopted was somewhat different to that proposed by Prof. Church. The basalt was roughly crushed, and then turned into a sieve. As the mineral is very brittle, a great quantity of it came through mixed with the finer particles of the basalt. It was again sifted so as to get rid of the small dust, and then thrown in small quantities at a time into a small porcelain basin containing Sonstadt's solution, and well stirred with a glass rod, to ensure that the heavier minerals were wetted with the solution, as otherwise they sometimes float on it. The unknown mineral then collected in a black scum on the surface, and was skimmed off with a feather, immediately deposited in a beaker of distilled water, and well washed to remove any traces of the solution. On contact with water, however, a little red iodide of mercury is precipitated, which can be redissolved, and washed away by a little iodide of potassium, so that there is no danger of a mineral so collected being contaminated by a trace of mercury.

As soon as a sufficiency of the mineral had been collected thus it was purified by being again floated on the liquid. A small quantity of other minerals (augite, felspar, &c.), which had been caught up in the first floatation—if I may use the word—sank to the bottom, and the unknown mineral was again collected and washed. By this process I succeeded in obtaining about 2 grammes of the mineral for analysis,* an amount which I doubt if I should had extracted after months of hard labour by any other method, and if I had the time and patience necessary to be devoted to the task.

Of course, there are many minerals which would be attacked by this solution, but a great number would be unaffected by it, for the short time they would be in contact with it most of the silicates would be utterly untouched by it, and a great number of separations might be effected. For instance, it would be possible to separate completely the three constituent minerals of granite—mica, felspar, and quartz—weigh them and determine absolutely their percentage, a matter which has yet only been determined by mathematical calculations, based on assumption which can be at least only approximately correct.

14, Hume Street, Dublin, March 4, 1878.

ON A

NEW METHOD OF WEIGHING PRECIPITATES.

By ARTHUR W. CLARK.

ONE of the most frequent mechanical operations that has to be carried out in the chemical laboratory is the drying of precipitates prior to weighing them. This manipulation is always tedious, and in some cases involves a considerable expenditure of time and patience, for it is evident that unless the precipitate is thoroughly dried the apparent weight will not be the real weight.

Arsenate of magnesia and ammonia is a precipitate which has to be most carefully dried, since at a temperature very little above 212° F. it is decomposed.

I shall endeavour to show in this paper how a precipitate can be weighed by merely washing it into an ordinary specific gravity flask from the filter, and then calculating the real weight from the weight of the flask completely with water and the precipitate.

The ordinary sp. gr. flask contains 1000 grains of pure water at a normal temperature. Now if we suppose such a flask to be filled with a substance whose specific gravity call a, it is obvious that the whole would weigh $1000\,a$ grs. (*plus* the weight of the flask). For instance, the sp. gr. of lead is about 10, which means that bulk for bulk lead is 10 times heavier than water. Suppose the flask to be completely filled with metallic lead, then the whole would weigh 10×1000 grains. Now let us suppose it to be only half filled with the substance, then the whole would weigh in grains $\frac{1}{2}\,1000\,a + \frac{1}{2}\,1000$. And so generally if the substance occupies $\frac{1}{x}$ th of the volume of the flask the whole will weigh in grains :—

$$\frac{1}{x} = 1000\,a + \frac{x-1}{x}\,1000.$$

Calling the weight w, and solving the equation, we get—

$$\frac{1}{x} = \frac{w - 1000}{1000\,(a-1)}$$

But since the whole volume (that is, the flask completely filled) would weigh $1000\,a$, the $\frac{1}{x}$th of the whole must weigh—

$$\frac{1}{x}\,1000\,a.$$

Substituting the above value for $\frac{1}{x}$ in this expression we get—

$$\frac{w - 1000}{1000(a-1)} \times 1000\,a$$

or—

$$\frac{(w-1000)\,a}{a-1},$$

which is the formula for calculating the real weight of the substance in the flask, w being the gross weight less the weight of the flask, and a being the specific gravity of the substance. In this formula it is obvious that $w - 1000$ is the expression for the increase in weight of the flask between the two weighings, *i.e.*, the weight when full of pure water and the weight when full of the substance and the pure water. Call this increase C, and the formula becomes—

$$\frac{C\,a}{a-1}$$

The following is an example of the utility of this method of weighing precipitates :—The specific gravity of the precipitate called arsenate of magnesia and ammonia is, prior to drying, about 3. A sample to be assayed for arsenic was treated in the usual way, and the precipitate collected on a filter and washed; it was then washed into a specific gravity flask capable of holding 4600·35 grains of water at the normal temperature. The whole was then found to weigh 4660·47 grains, so in this case $C = 60{\cdot}12$, and $a = 3$, therefore formula becomes—

$$\frac{60{\cdot}12 \times 3}{3-1}.$$

or—

$$\frac{180{\cdot}36}{2},$$

that is 90·18; therefore real weight of the precipitate was 90·18 grains.

I have used this method of weighing for four months, and am satisfied that the process is accurate and speedy, but of course great care must be taken in handling the flask, &c., so that the temperature may not be influenced by the heat of the hands, &c.

* This analysis will be shortly submitted to the Royal Irish Academy.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, March 7, 1878.

Dr. GILBERT, Vice-President, in the Chair.

AFTER the confirmation of the minutes of the preceding meeting, the following certificates were read for the first time:—G. H. Rutter, R. H. Jude, A. K. Huntington, K. H. C. Nevile. The name of Mr. M. Zingler, whose certificate was read for the first time on February 7, was accidentally omitted from the report of that date. The list of the Officers proposed for election on March 30 was read from the Chair. The names of the gentlemen retiring, &c., were given in the report of the last meeting, with one exception, that Mr. C. E. Groves retires from the Council instead of Prof. R. V. Tuson. It was also announced that Mr. Hall was prepared to receive subscriptions (of 10s.) from Fellows for the next volume of the *Proceedings of the Royal Society*.

The CHAIRMAN then called on Mr. PERKIN to read his paper, "*On some New Derivatives of Anisoil.*" Dry precipitated methyl-orthoxy-phenyl-acrylic acid is placed in contact with hydriodic acid (sp. gr. 1·94) for two or three days, the mixture being frequently agitated. The resulting product, drained by a filter-pump, and then added in small quantities to a cold saturated solution of sodium carbonate, great care being taken to prevent any rise in

temperature. The milky fluid thus obtained is distilled. Ortho-vinyl-anisoil separates from the distillate as an oily layer; it has the formula—

$$C_6H_4\begin{cases}(OCH_3)^o\\CH=CH_2\end{cases}.$$

It polymerises so quickly as to prevent the correct determination of its boiling-point, which is about 195° to 200° C. Heated for an hour to 150° it solidifies to a transparent glass-like substance. The odour of ortho-vinyl-anisoil differs from that of its isomer, para-vinyl-anisoil, and resembles coal-tar naphtha (sp. gr. at 15° 1·0095, at 30° 1·000). By a similar process, substituting, however, hydrobromic acid, ortho-allyl-anisoil was obtained, boiling without polymerising at 222° to 223° C. It is a highly refracting liquid, with sp. gr. at 15° 0·9972. Similarly, with hydriodic acid, ortho-butenyl-anisoil was obtained, boiling at 232° to 234°; sp. gr. at 15° 0·9817. In a previous paper the author endeavoured, without success, to prepare para-vinyl-anisoil from methyl-paroxy-phenyl-acrylic acid by treating with hydrobromic acid, &c. By substituting hydriodic acid he has obtained this substance, resembling in its properties the body prepared by distilling methyl-paroxy-phenyl-acrylic acid: its fusing-point was, however, +3° instead of −1°; sp. gr. at 15° 1·002. In conclusion, the author compares the ortho and para compounds as regards their physical properties:—

(1.) *Boiling-points.*

Para-vinyl-anisoil boils at ..	204° to 205°
Ortho-vinyl-anisoil boils at ..	uncertain
Para-allyl-anisoil boils at ..	232
Ortho-allyl-anisoil boils at ..	222 to 223
Para-butenyl-anisoil boils at..	242 to 245
Ortho-butylen-anisoil boils at..	232 to 234

(2.) *Specific Gravity.*

	15° C.	30° C.
Para-vinyl-anisoil ..	1·0029	0·9956
Ortho-vinyl-anisoil ..	1·0095	1·0000
Para-allyl-anisoil ..	—	0·9852
Ortho-allyl-anisoil ..	0·9972	0·9884
Para-butenyl-anisoil ..	—	0·9773
Ortho-butenyl-anisoil	—	0·9740

The ortho compounds refuse to crystallise even when placed in a freezing mixture; the para bodies crystallise freely. *a*-methyl-orthoxy-phenyl-acrylic acid from coumarin, treated with hydriodic acid, and then with an alkaline carbonate, yields an oil which is apparently identical with the ortho-vinyl-anisoil prepared from the *β*-acid. The author is engaged in the investigation of this acid.

The next paper was also by Mr. Perkin, and was entitled "*Note on the Action of Ammonia on Anthrapurpurin.*" In a previous paper the author mentioned that an ammoniacal solution of anthrapurpurin changes to an indigo-blue colour when heated in a sealed tube to 100° C. Hydrochloric acid throws down from this solution a dark purple precipitate, re-dissolving in ammonia to a blue solution. This substance dyes alumina mordants a purple, and weak iron mordants an indigo-blue colour. On examining this substance it proves to be unstable, easily resolvable into anthrapurpurin. If the solution above mentioned be heated in a sealed tube to 160° to 180° instead of 100° a purple solution results. On acidifying with hydrochloric acid a chocolate-coloured precipitate forms. This, when boiled with barium hydrate (after washing) dissolves to a purple solution: on acidifying a precipitate is formed. This, after washing and drying, is dissolved in alcohol. On concentration the dark red solution yields dark greenish or black crusts. This substance the author proposes to call anthrapurpuramide or amido-alizarin. It has the formula $C_{14}H_9NO_4$. It does not dye mordants. By the action of nitrous acid iso-anthraflavic acid was obtained.

After some remarks by Dr. Witt and Dr. Armstrong, the thanks of the Society were given to Mr. Perkin for his communications, and the Chairman called on Mr. G. S. Johnson to read a paper "*On certain Poly-iodides.*" In December, 1876, the author described the compound RI_3. As the mercury compound, HgI_6, is well known, it seemed probable that the true formula might be R_2I_6, and if so, that substitution-compounds might be obtained by displacing one atom of potassium by one atom of some other monatomic element. Silver was the element first tried. $AgR_3I_{12}RI+5H_2O$ was, however, the only salt the author succeeded in isolating. It is efflorescent over strong sulphuric acid, but deliquesces in air. It can be re-crystallised by dissolving in a small quantity of water and evaporation over sulphuric acid. The crystals present a stepped arrangement, are almost black, with a peculiar lustre. An excess of water decomposes the salt. The author next endeavoured to prepare the compound $R_2Tl_2I_{12}$, but without success, the only compound obtained being that discovered by Willm, $xTlI_3.RI+2H_2O$. Before the isolation of potassium tri-iodide, Biffard supposed that the solution of iodine in aqueous potassium iodide contained a definite periodide, because it gave a dark coloured precipitate with a solution of acetate of lead. By using alcohol as a solvent instead of water the author obtained a crystallised compound (a specimen of which was exhibited), not deliquescent, crystallising in square prisms. By gradual evaporation fairly large crystals were obtained, with six faces, two having a dark purple, four a greenish golden reflection. The compound can be re-crystallised from hot alcohol; sp. gr. 3·084. Analyses of the constituents led to the complicated formula $Pb_8C_{36}H_{54}O_{28}K_6I_{17}$. The author has not yet been able to suggest a rational formula.

The next paper was "*On an Improved Form of Wash-Bottle,*" by T. Bayley. To prevent the reflux of steam or other gases—such as ammonia, &c.—into the mouth of the operator, the author suggests the following modification of the ordinary wash-bottle:—The mouthpiece is provided inside the bottle with a Bunsen valve—*i.e.*, a piece of india-rubber tube with a slit—a third tube is inserted in the cork, having two ⊤-tubes outside the bottle: the ends of these ⊤'s are connected by a piece of caoutchouc tube which can be closed by pressure. The orifice of this third tube between the two ⊤'s is closed by a small cork. The only connection, therefore, passing outwards, between the inside of the bottle and the atmosphere, except by the washing-jet, is through the india-rubber tube connecting the two ⊤'s. The operator blows in through the Bunsen valve, closing the said india-rubber tube by pressure. As soon as he ceases blowing the valve shuts, and prevents any reflux; whilst he can, by taking off his finger from the india-rubber tube, stop the action of the washing-jet, or by keeping the pressure on continue the action for nearly a minute. This third tube also serves to pour out water when the bottle is reversed. A sketch of the arrangement accompanies the paper.

The last paper was "*On the Preparation of Glycollic Acid,*" by R. T. Plimpton. The author made two attempts to prepare calcium glycollate by following the directions of Prof. Church (*Journ. Chem. Soc.*, series ii., vol. i.). 2 lbs. of granulated zinc and 2 ozs. of oxalic acid were used in each operation. Some needles resembling calcium glycollate were obtained, but the quantity was too small for analysis.

The Society then adjourned to March 21, when a paper on "Aromatic Nitrosamines," by Dr. Otto Witt, will be read.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, February 19, 1877.

E. W. Binney, F.R.S., F.G.S, President, in the Chair.

"*Note on a Method for Determining the Coefficients in Chemical Equations,*" by James Bottomley, D.Sc.

When two or more chemical compounds act upon one another so as to produce new compounds, provided we

know the composition of each, the result may be expressed by a chemical equation. Sometimes, in drawing out the equation, we have some trouble to determine the coefficients to be used with the compounds on each side.

As far as I am aware, the methods used are purely tentative. It occurred to me that in cases where the composition of all the products is known, we might apply the method of indeterminate coefficients as follows :—Let S be the symbol of an element and a_1, b_1, &c., the number of atoms of that element occurring in the various compounds entering into the equation.

S_2 and a_2 b_2, &c., have the same meanings with reference to another element. The letters a_1b_1, a_2b_2, &c., may have any positive integral value including O. Then a chemical compound may be denoted by S_1a_1, S_2a_2, &c., which for brevity may be denoted by A. So B will denote a compound of the form S_1b_1, S_2b_2, &c., and so on for other compounds. Hence the chemical equation may be written in the form—

$$P_1A+P_2B+\&c.=Q_1M+Q_2N+\&c. \quad \ldots\ldots \quad (1)$$

P_1, P_2, Q_1, Q_2, &c., being undetermined. Then, equating the terms containing S_1S_2, &c., we have equations of the form—

$$S_1(P_1a_1+P_2b_1+\&c.)=S_1(Q_1m_1+Q_2N_1+\&c.$$
$$S_2(P_1a_2+P_2b_2+\&c.)=S_2(Q_1m_2+Q_2n_2+\&c.)$$
$$\ldots\ldots\ldots\ldots\ldots=\ldots\ldots\ldots\ldots\ldots$$
$$Sn(P_1a_n+P_2b_n+\&c.)=Sn(Q_1m_n+Q_2n_n+\&c.$$

From the above equations the letters S_1, S_2, &c., might have been omitted, but are retained to show that there will be as many equations as elements. Hence if the number of elements be equal to the number of compounds we shall have sufficient equations to determine P_1, P_2, Q_1, Q_2, &c. If the number of compounds exceed the number of elements by unity, take any one of the undetermined coefficients, then all the rest may be determined as multiples of that one, and replacing these values in equation (1), both sides will be multipled by the same arbitrary quantity, which may therefore be omitted.

Within the last few years chemical compounds of considerable complexity have been obtained, and for their quantitative reactions such a method as that suggested might be serviceable. Annexed are two examples of the method applied to well known chemical equations.

(1.) Copper and nitric acid yield water, copper nitrate, and nitric oxide—

$$P_1Cu+P_2(HNO_2)=Q_1(H_2O)+Q_2[Cu(NO_3)_2]+Q_3(N_2O_2).$$

Hence we have the system of equation—

$$P_1=Q_2, P_2=2Q_1, P_2=2Q_2+2Q_3, 3P_2=Q_1+6Q_2+2Q_3.$$

Hence we get $P_2=\frac{8}{3}P_1$, $Q_1=\frac{4}{3}P_1$, $Q_2=P_1$, $Q_3=\frac{P_1}{3}$ substituting in the equation and multiplying each side by $\frac{3}{P_1}$ we get the usual equation—

$$3Cu+8HNO_3=4H_2O+3Cu(NO_3)_2+N_2O_2.$$

II. Potassium ferrocyanide, water, and sulphuric acid yield ferrous sulphate, ammonium sulphate, potassium sulphate, and carbonic oxide—

$$P_1(C_6N_6K_4Fe)+P_2(H_2O)+P_3(H_2SO_4)=$$
$$=Q_1(CO)+Q_2(FeSO_4)+Q_3(NH_4)_2SO_4+Q_4(K_2SO_4).$$

Here the group SO_4 may be treated as an element. From the above equation we get the subsidiary equations—

$$6P_1=Q_1, 6P_1=2Q_3, 4P_1=2Q_4, P_1=Q_2, 2P_2+2P_3=8Q_3, P_3=Q_2+Q_3+Q_4.$$

Hence we get—

$$Q_1=6P_1, Q_2=P_1, Q_3=3P_1, Q_4=2P_1, P_2=6P_1, P_3=6P_1.$$

Replacing these values in the equation and dividing both sides by P_1 we get—

$$C_6N_6K_4Fe+6H_2O+6H_2SO_4=$$
$$6CO+FeSO_4+3(NH_4)_2SO_4+2(K_2SO_4),$$

which is the equation given by Fownes.

CORRESPONDENCE.

AMMONIA IN FILTERED WATER.

To the Editor of the Chemical News.

Sir,—Professor Bischoff has read the sentence (paragraph 2) in my letter (Chemical News, vol. xxxvii., p. 38) in a different light to that which I intended when writing it. It was my intention to have conveyed the meaning that it is to the reducing influences (not influence as misquoted) of sulphuretted hydrogen and iron existing as ferrous compounds in the London clay, Greensands (and carboniferous) formations, that the presence of ammonia and the small quantity of nitrates (generally nil) is due,—that a resemblance is met with in the case of waters passed over spongy iron (*vide* exception at close of paragraph 5) also due to reducing influences, and that the ammonia resulting from such processes should not be confounded with the ammonia formed as a first product of the decomposition of animal organic matter. The whole sentence was an answer to paragraph 1, and these two paragraphs stand distinct from the remainder of the letter.

On the cause of the formation of ammonia the compilers of the Sixth Report of the Rivers Pollution Commission themselves are reticent in passing a decided opinion ; this is instanced from the following extract, page 98. "The greensands contain, almost invariably, protoxide of iron, which probably exercises a reducing effect upon the nitrates and nitrites present in the water, removing their oxygen and transforming a portion of their nitrogen into ammonia, whilst the remaining nitrogen escapes as gas. In some cases even the sulphates present in the water are attacked and reduced, and sulphuretted hydrogen generated. The evidence of previous animal contamination is thus diminished or even obliterated altogether, whilst the water acquires a considerable proportion of ammonia." While I do not assert that the ammonia in water from the above mentioned strata is due to the combination of atmospheric nitrogen with hydrogen, I should be sorry, judging from analogies, to contradict a statement that a part may have been so caused. Regarding the discepancies in the amounts of ammonia : —In the Rivers Pollution Commission experiments the water was not submitted to spongy iron alone : after filtration it was exposed to the air in the form of a fine jet ; this is necessary to peroxidise the first formed oxide of iron ; a filtration through sand then ensued, to effect the removal of the ferric hydrate. Is not this accompanied by a removal of some of the ammonia ? The fineness of the jet and the rate of sand filtration probably constitute important factors, especially as the sand is not covered with water.

In my experiments, as I have already mentioned, the oxidation to and removal of ferric hydrate was not attempted. In other words, in the Rivers Pollution Commission experiments, the water was submitted to both reducing and oxidising filtering media, in my experiments to the reducing medium alone. I have given an analysis, entitled "Bad water." This I selected as an instance on account of the abnormal amount of ammonia obtained.

Comparative filtration (as regards speed) of like samples of water shows that with an oxidising filtering medium the organic carbon is largely removed, with a reducing medium the organic introgen is removed in a relatively greater degree than with oxidising filters. This formula holds good with water contaminated with animal matters only ; in waters containing much vegetable matter the elimination of the nitrogen is difficult, and my former letter was written principally to call attention to this subject.

I would take this opportunity of requesting Professor Bischoff to determine the ammonia in London waters *passed over spongy iron alone*. The subject of the rapid action of spongy iron deserves attention. I believe it

will be found, that as far as regards removal of organic matter, slow or rapid filtration makes but little difference; in all the experiments I have made the filtration has been effected at about fifteen times the speed at which the Rivers Commission filtrations were made.—I am, &c.

JAMES DEATH.

Laboratory, St. Georges Road, Southwark, S.E.
March 6, 1878.

CHEMISTS AND CHEMISTS.

To the Editor of the Chemical News.

SIR,—"A Credulous Chemist" appeals to his "friend, Professor Attfield," for evidence of my statements respecting the history of the name or title of *chemist*. If he will, by appending his name to his notes, afford me evidence by which to judge of the nature of his credulity and his friendship, I will endeavour to satisfy him. I agree with him that a writer's name to a letter is not a perfect guarantee of the soundness of the writer's statements, but it is at least more valuable than a pseudonym. I will not push the *tu quoque* argument too far; I desire to be courteous, and I am sensible of the value of anonymous writing in our periodicals; but, if he will please excuse me, I would rather not reply to pseudonymous correspondents.—I am, &c.

JOHN ATTFIELD.

Ashlands, Watford.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwis expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 5, February 4, 1878.

On Anhydrous Trichloracetic Acid.—A. Clermont—The author obtains this compound by the action of anhydrous phosphoric acid upon trichloracetic acid.

Combinations of Quercite.—L. Prunier.—The author as examined the action of hydrochloric acid upon querite under a variety of circumstances.

Use of the Polarising Microscope with Parallel Light for the Determination of the Mineral Species contained in Slender Discs of Eruptive Rocks.—A. Michel-Lévy.—Not suitable for abstraction.

Leadhillite of Matlock.—E. Bertrand.—The leadhillite of Matlock is identical in its crystallographical form from the specimens found at Leadhills, but its optical behaviour is different.

New Specific Gravity Apparatus.—F. Pisani.—The description of this instrument does not admit of condensation.

Recent Researches on the Function of Moulds and on their Power of Inverting Sucrose.—M. A. Béchamp.—A critique on a paper by M. U. Gayon (p. 52 of the present volume).

On the Telephone.—L. de Champvallier.—The telephone is found to act satisfactorily at a distance of 14 kilos. Morse messages, which pass along wires distant from 45 to 90 centimetres, can be read even when these accompany the telephone wire merely for the length of 300 metres. Two telephone lines adjacent, but not connected, mix their dispatches.

On the Telephone.—A. Demoget.—In front of and at a millimetre distance from the vibrating disc of a Bell's telephone the author places one or two similar vibrating plates, but pierces in the centre of the first a circular orifice equal in diameter to that of the magnetic rod; in the second, an orifice of a larger diameter. He thus augments not merely the intensity of the sounds transmitted, but their distinctness.

No. 6, February 11, 1878.

Observations on a Memoir by M. Dieulafait on Boracic Acid.—M. Bidaud.—M. Dieulafait's method of detecting the existence of 1-100000oth grm. of boron by means of the flame of hydrogen depends on presenting a basic saline mixture containing boracic acid, to which a strong acid has been added, to a Bunsen burner, supplied either with pure hydrogen or common coal-gas. A characteristic green flame is produced when the interval between the saline mixture and the external visible part of the flame is from 2 to 4 m.m. M. Bidaud shows that he called attention to this method in 1873, using tartaric acid to liberate the boracic acid.

Bulletin de la Societe Chimique de Paris, No. 2, January 20, 1878.

Analysis of Silicates by Means of Lead Oxide.—Gaston Bong.—The ordinary methods for the analysis of silicates require high temperatures and leave certain important substances undetermined. The use of oxide of lead obviates these difficulties; the mineral is attacked at a low temperature, which is kept up as long as is necessary for complete decomposition, which is generally effected with ease, and may be promoted by a very fine comminution of the substance under analysis, and by an increase in the quantity of oxide of lead. Ordinarily it is convenient to treat the sample with three times its weight of minium, the purity of which has been previously ascertained. The ignition should take place in a platinum crucible, and the silicate must therefore be previously calcined to remove any carbonaceous matter. The crucible should likewise be ignited in an oxidising atmosphere. When the mass has been well melted in the crucible it is allowed to cool, and then treated with nitric acid, which detaches it readily in a few minutes. The solution is continued in a porcelain capsule, and the whole is evaporated to dryness to eliminate the silica. It is then re-dissolved in nitric acid, avoiding excess, filtered to remove silica, largely diluted with water, and the lead is then precipitated with sulphuretted hydrogen. After filtering off the lead sulphide all the elements present will be found in the filtrate except the silica already determined. For the determination of the alkalies it is merely necessary to precipitate with ammonia, after having added a salt of magnesia or oxalic acid in case of silicates rich in phosphoric acid or in lime. The filtrate generally contains merely the alkalies mixed with the excess of magnesian salt which is separated by known methods. The same method is applicable to the analysis of aluminates.

Extraction of the Platinum Metals as Practised in German Refineries.—M. Opificius.—The ferric chloride resulting from refining gold contains, in addition to gold in suspension, platinum, palladium, silver chloride, iridium, and rhodium in solution, as well as copper, antimony, lead, bismuth, arsenic, tin, selenium, and tellurium. This solution is treated with iron, which yields a pulverulent metallic deposit containing the elements above mentioned. After the mechanical removal of compact fragments of iron, the finely divided iron is removed by digestion with ferric chloride, which dissolves at the same time a part of the copper, and also of the palladium if the digestion is carried too far. The residual deposit is washed with dilute hydrochloric acid, dried, and melted with carbonate of soda and charcoal. The selenium is found in the scoriæ as sodium seleniate. The regulus is granulated and treated with *aqua regia* with an excess of hydrochloric acid insufficient for the removal of all the metal, the first object being to dissolve out the copper as

this metal impedes the separation of platinum and palladium. This operation is repeated several times till all the copper is dissolved. The last solution contains a part of the palladium, which may be re-precipitated by the introduction of fine copper wire. The remaining metal is then entirely dissolved in *aqua regia*, diluted with water to throw down antimony, then concentrated again, and mixed with ferrous chloride to precipitate the gold. It is, however, better to precipitate the gold by the galvanic method and then separate the platinum as chloro-platinate of ammonium, which, on ignition, leaves platinum sponge containing not more than 0·5 per cent of impurities. The mother-liquids from the chloro-platinate containing an excess of sal-ammoniac serve for the precipitation of fresh portions of platinic liquids, and thus at the same time the palladium from several operations is concentrated into one liquid. On concentration the rest of the chloro-platinate crystallises, and in the final mother-liquors the palladium is thrown down as yellow chloride of palladammonium by the addition of hydrochloric acid and ammonia in slight excess.

Applications of Ferro-manganese.—M. Henderson.—The author has succeeded in preparing on the large scale ferro-manganese containing as much as 75 per cent of manganese, and consequently five or six times richer than spiegeleisen, which it supersedes, and proves the antidote to phosphorus.

Action of Potassium Nitrite upon Nitranilide and Acetonitranilide.—A. Müller.—If potassium nitrite is added to a somewhat concentrated aqueous solution of nitracetanilide mixed with nitric acid (1½ to 2 molecules of the nitrite to 1 mol. nitracetanilide), and the mixture is then supersaturated with ammonia, nitrogen is given off, and a red crystalline body is deposited, identical in its properties with Vogel's zinalin. It is sparingly soluble in water, but dissolves with a red colour in alcohol, ether, chloroform, and carbon disulphide. Alkalies dissolve it with a blood-red colour, and acids re-precipitate it in yellow flakes. It dyes silk and wool yellow and orange shades, which turn red on contact with ammoniacal vapours, but resume their former colour on exposure to air. Its salts dye an unstable violet, which passes into orange when washed in water. To obtain it on the large scale 1 part of acetanilide is heated to 75° in 8 parts nitric acid, an equal volume of boiling water is added, and the filtrate is treated with potassium nitrite and ammonia. The composition of this body is $C_{18}H_{13}N_5O_3$ and it is possibly phenol-bidiazonitrobenzol.

No. 3, February 5, 1878.

Memoir on Ultramarines.—E. Guimet.—From this lengthy paper we extract the author's remarks on the part played by each of the constituents of ultramarine. *Oxygen.*—According to the author's experiments the production of the colour is due to this element. In its absence the sulphides cannot generate ultramarines; the presence of hyposulphites is required for the formation of a stable colour. *Sulphur.*—With the same proportions of the other constituents a small amount of sulphur gives a light blue, which darkens as the sulphur is increased. When, however, a certain shade has been reached, depending on the proportions of other substances in the mixture, any further excess of sulphur is eliminated either by volatilisation or as sulphate of soda. *Soda.*—The proportion of soda in ultramarines is always the same, about 20 per cent. Any excess of soda introduced into the original mixture disappears as sulphate. *Silica.*—Its proportion in ultramarines is tolerably constant, from about 37 to 38 per cent, and its function has not yet been clearly defined. *Alumina.*—The shade of the blue depends on the quantity of alumina contained in the original mixture. When the proportion of alumina lessens that of sulphur increases, whilst the relative amounts of silica and of soda do not change. Hitherto the light or pure blue ultramarines and the dark or rosy ultramarines have been respectively designated as poor in silica or rich in silica, while the fact is that they all contain silica in the same proportion.

Preparation of the Alcoholic Chlorides and their Application to the Production of Colouring Matters.—MM. Prosper Mounet and F. Reverdin.—Already noticed.

Preparation of Œnolin.—Eug. Varenne.—Lees of wine are stirred up with lime so as to form a thin blackish grey paste. This is thrown upon a filter, washed, drained, stirred up in alcohol at 95°, and mixed with sulphuric acid enough for the exact saturation of the lime present. The alcohol, which holds the œnolin in solution, is then filtered off and distilled in the water-bath, when the œnolin is left in a dry state. It is used for improving the colour of wines.

No. 4, February 20, 1878.

Remarks on the Memoir of MM. F. Schmidt and B. Tollens on the Lactobutyrometer.—E. Marchand.—MM. Schmidt and Mollens have proposed the use of alcohol at 92 per cent instead of 86 per cent, as originally suggested by the author. He admits that alcohol of the higher strength secures more readily the separation of the stratum of matter to be determined, but states that in milks rich in protein compounds it occasions the formation of a thick magma. He infers that Schmidt and Tollens have evaporated the milk after mixture with sand, and have then extracted the butter by lixiviation with ether. This procedure he condemns as faulty, because the fatty matter imprisoned in the casein and the coagulated albumen escape in part the action of the solvent. He considers that the only method for the exact determination of the butter is to render the milk alkaline by the addition of caustic soda, and then to exhaust by successive washings with ether.

Separation of Vanadium from Iron and Aluminium.—A. Bettendorff.—If vanadic acid is present in solution along with alumina, the addition of ammonia precipitates it as yellow vanadiate of alumina, insoluble in excess. If phosphate of ammonia is added and the mixture heated the precipitate turns white and is converted into alumina phosphate, while the vanadic acid remains soluble as ammonia vanadiate. In presence of ferric salts the reaction is similar. To facilitate the settling of the alumina phosphate, which is washed by decantation, sal-ammoniac is added to the solution.

Reimann's Färber Zeitung,
No. 7, 1878.

The editor, in an able leader, points out that apprenticeship is no longer an adequate method for acquiring a knowledge of the industrial arts.

No. 8, 1878.

This issue contains a critical inquiry into a case of arsenical poisoning which has been commonly ascribed to the industrial use of arseniferous magenta. The writer points out that beer brewed from glucose syrup constantly contains small proportions of arsenic.

MISCELLANEOUS.

Presentation to Dr. Muter.—On Wednesday, March the 6th, the present major and minor Students of the South London School of Pharmacy met their director, Dr. Muter, at the conclusion of the Chemical Lecture, and presented with an address expes sing their respect for him as a teacher, and their warm feeling towards him personally. The address was accompanied with the gift of a silver and crystal *Epergne*, tastefully loaded with fruit and flowers. The presentation was to have been made on the Doctor's birthday (February 27), but owing to a delay in the production of the inscription, &c., it had to be deferred.

Blowpipe Apparatus.—The Council of the Society of Arts having added Blowpipe Analysis to their list of annual examinations, were anxious to obtain a better box of apparatus for qualitative purposes, to be sold retail for a guinea, than any now sold for that sum. To effect this, they offered a prize of £10, with the Society's silver medal, the competition being international. The box selected for the prize was sent by Messrs. Letcher, of St. Day and Camborne, Cornwall. The award was made by the following committee:—Major-General Cotton (chairman of the Council), Professor Abel, F.R.S., Dr. C. Le Neve Foster, Captain Douglas Galton, F.R.S., Admiral Sir Erasmus Ommaney, F.R.S., Mr. E. C. Tufnell, and Professor Warington Smyth, F.R.S.

NOTES AND QUERIES.

"Safety Matches."—Like your correspondent, Bertram A. Muirhead, Lieut. R.N., I found by experiment a long time ago that the "Box" is by no means necessary to obtain a light from these so-called "Safety Matches," as they readily ignite by being brought in contact with other surfaces. Any one can prove this by drawing a match briskly in a continuous line from two to three feet in length along an ordinary rough-boarded dry floor, such, for instance, as those we find at railway stations. The same result can be obtained if drawn similarly along a rough dry Kamptulicon floor, such as used in offices, &c., and I have obtained a similar result, although not so readily, by turning up the sole of the boot and drawing a match briskly across this. I presume these results are brought about as a consequence of the temperature being raised by simple friction. Since reading your correspondent's note I have tried the effect of these "Safety Matches" in contact with coal and find ignition certain and almost immediate. —GEO. TUNBRIDGE, Gas Works, Leicester.

"Safety Matches."—It may not be out of place to mention a fact concerning the so-called "Safety Matches." I have seen them ignited by striking them with an elliptical sweep towards the striker on a glass shop-counter, and, attempting to do likewise, I also ignited one after the third attempt. The polish of the glass had been somewhat worn off, hence, I presume, the ignition must have occured through friction and not through any chemical action.—H. C. STANDAGE.

MEETINGS FOR THE WEEK.

MONDAY, 18th.—Medical, 8.
—— London Institution, 5.
—— Society of Arts, 8. "The Application of Photography to the Production of Printing Surfaces and Pictures in Pigment," T. Bolas, F.C.S.

TUESDAY 19th.—Civil Engineers, 8.
—— Royal Institution, 3. "Protoplasmic Theory of Life, and its Bearing on Physiology," Professor Garrod.
—— Photographic, 8.
—— Zoological, 8.30.
—— Society of Arts, 8. (African Section). "Egypt; its Commercial Changes and Aspects," Mr. B. Francis Cobb.

WEDNESDAY, 20th.—Society of Arts, 8. "Emery and Corundum Wheels, for Grinding and Surfacing Metals and other Materials," A. H. Bateman, F.C.S.
—— Meteorological, 7.
—— Geological, 7.
—— Society of Public Analysts, 8. "On the Amendment of the Sale of Food and Drugs Act," A. Wynter Blyth, M.R.C.S. "Experiments on the Determination of the Free Acids of Vinegar," Messrs. A. H. Allen, F.C.S., and R. Bodmer.

THURSDAY, 21st.—Royal, 8.30.
—— Royal Institution, 3. "Chemistry of the Organic World," Prof. Dewar.
—— Zoological, 4.
—— London Institution, 7.
—— Chemical, 8. "On Nitrosamines," Dr. Witt. "On a New Method for the Volumetric Estimation of Cyanides," Mr. J. B. Hannay. "On Certain Bismuth Compounds," Mr. M. M. P. Muir.

FRIDAY 22nd.—Royal Institution, 8. Weekly Meeting. "Recent Experiments on Fog Signals," Prof. Tyndall, 9.
—— Quekett Club, 8.

SATURDAY, 23rd.—Royal Institution, 3. "Gleanings from the Natural History of the Ancients," Rev. W. Houghton.

ERRATA.—P. 89, col. 2, line 5 from bottom, *for* "Bishop's" *read* "Hislop's." P. 97, col. 2, line 14 from top, *for* "either a yellow, yellow-green, or blue-green," *read* "either a yellow-green or blue-green."

TEXT-BOOKS OF SCIENCE.

In small 8vo., with 72 Diagrams and Figures, price 3s. 6d.

INORGANIC CHEMISTRY (Introduction to the Study of). By W. ALLEN MILLER, M.D., late Prof. of Chem King's Coll., London. New Edition, with Questions for Examination

London: LONGMANS and CO.

Mr. WATTS'S DICTIONARY OF CHEMISTRY

Complete in 7 vols., medium 8vo., price £10 16s. 6d.

A DICTIONARY of CHEMISTRY, and the Allied Branches of other Sciences. By HENRY WATTS, F.R.S., assisted by eminent Scientific and Practical Chemist

"The greatest work which England has yet produced on chemistry—one of the greatest, indeed, which she has produced upon any scientific subject—is finished at last, and we are able to congratulate Mr. Watts most sincerely upon its completion."—*Chemical News.*

"The English language is not rich in lexicons of science: we would point to this work as a model upon which others might be framed. It certainly exhausts the subject up to the date of publication, and therefore forms as it were the balanced ledger of the chemist."—*Athenæum*

London: LONGMANS and CO.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays.. ..	£2	2 0
200 Specimens, in Cabinet, with 5 Trays.. ..	5	5 0
300 Specimens, in Cabinet, with 9 Drawers ..	10	10 0
400 Specimens, in Cabinet, with 13 Drawers ..	21	0 0

More extensive Collections at 50 to 5000 Guineas each.

J. I. HEADLY, ENGINEER, Cambridge, Maker of Steam Engines, Bone Mills, and other Machinery for Chemical Works; also Whole and Ground Coprolite.

PRELIMINARY ANNOUNCEMENT.

Valuable Freehold Estate and Chemical Works, within one mile of the Tyne Docks, in the County of Durham.

MOSES PYE and SONS have been honoured with instructions to prepare for SALE BY AUCTION, early in May,

"THE LAKE CHEMICAL WORKS,"

South Shields, where the manufacture of soda-ash, refined alkali, soda crystals, bleaching-powder, and the extraction of copper by the wet process, combined with the production of purple ore, have been successfully carried on.

The works occupy an area of five acres, with river frontage for shipment on the north, and nine acres directly opposite, leading up to the South Shields Branch of the North-Eastern Railway. Also

"BYLTON FARM,"

with all necessary farm buildings, together with 50 acres of arable and pasture land, including a field with long river frontage, an excellent site for a manufactory. Also

"BYLTON VILLA,"

with gardens, pleasure grounds, stables, coachhouses, coachman and gardener's houses, comprised in an area of three acres, in the occupation of G. D. Mease, Esq., the owner; and also

TWO SELF-CONTAINED DWELLING HOUSES,

of ten rooms each, and Workmen's Houses.

The whole will be sold in one lot.

Plans and detailed particulars are being prepared, and will be ready on the 25th March inst.

Should intending purchasers wish any further information before the issue of the detailed particulars, it will be furnished on application to the AUCTIONEERS, 7, Collingwood Street, Newcastle, or to

Mr. ROBERT KIDD, Solicitor,
43, Dean Street, Newcastle, and
113, Norfolk Street, North Shields.

THE CHEMICAL NEWS.

Vol. XXXVII. No. 956.

SHORT REPORTS FROM THE CHEMICAL LABORATORY OF TRINITY COLLEGE, DUBLIN,

By J. EMERSON REYNOLDS, M.D.
Professor of Chemistry, University of Dublin.

No. IV.*

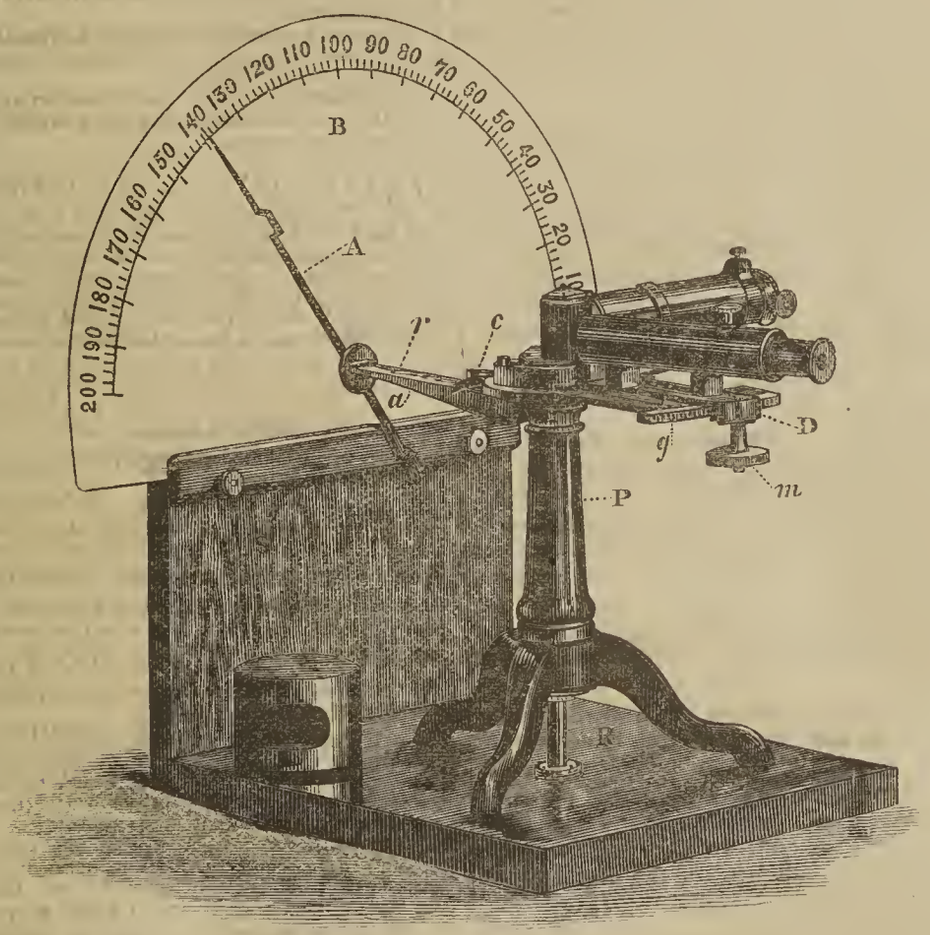
On a New Form of Measuring Apparatus for a Laboratory Spectroscope.

The measuring apparatus for a laboratory spectroscope which I have been asked to describe, was fitted about a year ago to an instrument in common use in the College Laboratory, and has afforded very satisfactory results. My chief aim in planning the arrangement, was to facilitate the measurement and identification of spectral lines and the mapping of spectra under circumstances admitting of little general illumination.

The spectroscope to which the apparatus is fitted has two fixed flint glass prisms, the refracting angle of each being 60°. This instrument is shown in the annexed engraving. When in use the prisms are covered by a brass cap provided with openings for the collimating and observing telescopes. The movable arm D that supports the observing telescope, also carries a vernier, which is moved with the telescope over a graduated arc, and in this usual way the relative positions of the several lines of a given spectrum can be determined. The angular distance traversed in passing from the extreme red to extreme violet is necessarily small owing to the low dispersive power of the instrument; but this, I need scarcely say, is an advantage rather than the reverse in a spectroscope, which is commonly employed as an aid in ordinary qualitative analysis.

The graduations of the arc are unavoidably close and difficult to read in a feeble light; consequently the eyes of the observer become speedily tired and unfitted for the examination of faint spectra. Nevertheless, measurements made with the graduated arc and vernier are, in my experience, more trustworthy and satisfactory than those obtained with even the best photographed scale that I have had the opportunity of working with. Desiring, then, to retain the method of direct angular measurement, I sought to multiply the motion in such a manner as to obtain wide readings on a convenient scale. After many trials in different directions the form of apparatus which I shall now describe was finally adopted.

Description of the Apparatus.—The annexed woodcut, which is taken from a photograph, represents the whole apparatus. The index A attached to the spectroscope,



latter being supported in the manner shown by the stand S,* to which the spectroscope is also screwed by means of the rod R. The index is attached to a milled head which moves stiffly on a stout steel rod *r*; the latter can revolve in little bearings supported by the projecting arm of "angle brass" *a*, the other end of the rod being let into a hole drilled in the head of the pillar, P, of the instrument. On the rod just mentioned, and immediately

* For Report No. I., "On Glucinum; its Atomic Weight and Specific Heat," see *Philosophical Magazine* [5], vol. iii., p. 38; for No. II., "On a New Mineral Borate," and for No. III., "On an Analysis of Lievrite, by Mr. Early's Method," see *Phil. Mag.* [5], vol. iii,, pp. 284 and 287.

* The stand is of stout walnut wood. A rebate of the thickness of the glass plate is cut to the depth of three centimetres from the vertical piece of the stand. The straight edge of the plate is laid in the groove and is there secured, in part by a pin passing from behind through a hole drilled in the glass, and in part by a wooden slip screwed on in front.

beneath *c*, a small toothed wheel is securely keyed. The diameter of this wheel is about one centimetre, and the teeth upon it are fine and well cut. *c* is a stout metallic strip, five centimetres long, whose lower edge is serrated so as to correspond accurately with the teeth of the wheel on the rod *r*, and to act upon the teeth directly, so as to cause the rod carrying the index, A, to rotate easily. This strip is bent to a curve whose radius is equal to the distance from the axis of the pillar, P, of the instrument to the middle of the toothed wheel. The strip is attached to a stout arm, and this is in turn screwed to the slightly projecting end of the heavy plate, D, which carries, and of course moves with, the observing telescope, the motion being communicated to the latter by turning the milled head *m*. As the observing telescope moves over the graduated arc *g*, the index A moves in front of the graduated plate B, but in the opposite direction, for the motion of D is communicated to the rod *r* by means of the serrated slip *c*. When the fittings are well made, the movement of the index, A, is steady and corresponds in both directions with those of D. By the simple means described, a very slight motion of the observing telescope produces a comparatively considerable displacement of the index A.

In my instrument, the telescope and the index move in opposite directions. Any objection on this score can be removed, for it is only necessary to point out that the motions may be made to coincide in direction by placing *c* under instead of over the toothed wheel.

Graduation of the Glass Plate.—It is very desirable that the graduations on the plate and on the arc of the instrument should agree; the best mode of securing this is to graduate the plate with the aid of the arc. For this purpose the telescope is moved into such a position that the rays less refrangible than the red potassium line shall occupy the field of view; the zero of the vernier is then made to coincide with the nearest convenient degree marked on the arc. The rod *r* is then firmly grasped and the index A brought down to a horizontal position, and a fine dot made on the plate under the point by means of a pen dipped in "black japan." This point is taken as the zero of the scale. Each half degree is marked off in a similar manner until the semicircle is graduated. The two scales are again compared at different points, and the opal glass plate removed; each large division, corresponding to half a degree, is then subdivided into 10* equal parts. Finally, the semicircle is numbered from zero up to 200; each division of the scale, therefore, corresponds to 3′ of the arc *g*. In my spectroscope the angular motion of the observing telescope is magnified 25 times, and the width of each division of the glass scale is 2½ millimetres, so that the readings are easily made in a feeble light without straining the eyes of the observer.

Reading off Positions of Spectral Lines.—In commencing an observation it is always desirable to see that the point of the index A stands at the zero of the glass scale when the telescope is in the corresponding position on its scale. Any adjustment of the index that may be necessary is easily made in the way already described, namely, by firmly holding the rod *r* and turning the milled head which carries the index to the desired extent. The actual reading of the position of a line to which the point of the fine needle in the eye-piece is brought is then made from the glass scale.

An exceedingly feeble light suffices to enable the operator to read the wide divisions on the white scale; but in observing very faint lines I do not read by reflected light, but faintly illuminate the scale by means of a very small gas jet or lamp placed behind it. Sufficient light is transmitted by the opal glass to enable the readings to be easily and quickly made, while the eye of the operator is retained in a sensitive condition for feeble rays. Moreover, in reading it is not necessary to move the head away from the eye-piece of the instrument.

* In the woodcut only five subdivisions are shown.

I have tried with success a mode of determining small differences with this apparatus which could doubtless be applied with advantage in mapping spectra with instruments of high dispersive power.

The glass plate B was removed from its stand and the index from the rod *r*; I then attached to the latter a cork carrying a small mirror placed at a suitable angle. A spot of light was reflected from this mirror and made to fall on a screen placed several metres away. The relative distances between the members of groups of closely ruled lines (those of the nitrogen spectrum) were then easily determined in this manner, as the actual motion of the needle from point to point was greatly magnified.

The relative positions and widths of the lines seen with the instrument are easily laid down on a millimetric scale. I have had a number of 200 m.m. scales printed on narrow slips of paper; and the graduations are lithographed on a band of six equidistant lines, which thus serve for marking off intensities, according to Bunsen's graphic method. One millimetre corresponds to one unit of the scale on the opal glass screen, and consequently to three minutes as read off with the vernier on the graduated arc of the instrument. Differences corresponding to 1′ can, therefore, be easily estimated and represented on the millimetric scale.

But one other practical point need be mentioned. I find it exceedingly convenient to mark off on the opal glass scale the positions of the more important lines of the elements whose spectra are easily obtained with the aid of the Bunsen flame. The symbol of the element to which a particular line or band belongs is legibly written under the particular point of the scale, and connected by a line with the point in question. Identification of the bright lines observed in the spectrum of an unknown compound is thus greatly facilitated.

I may be permitted to add that the measuring apparatus described has been fitted to the spectroscope used in the College Laboratory by Messrs. Yeates and Son, of this city, whom I have to thank for the care and skill with which they carried out the details of construction.

A NEW METHOD OF WEIGHING PRECIPITATES.

By CHARLES F. CROSS.

Your correspondent's proposal to determine the weights of precipitates by direct observation, without previous drying and ignition, of the water displaced by them, appears to me to lose much value in face of the slender knowledge which we possess of the true volume occupied by compounds in the hydrated state, which is that of the greater number of precipitates. For this is dependent upon two factors—(1) the change of volume experienced by water in effecting hydration, and (2) the degree of the hydration; and we are in possession of very little definite knowledge of either. Not only so, but what we have seems to show that both are so variable, so much dependent upon surrounding conditions, as to render it impossible to arrive at the weight of a hydrated body by a determination of its volume, even were this possible. Take the case of hydrated ferric oxide, which we may select as typical of the large class of precipitated oxides. I recently undertook a series of determinations of the volume of this compound as precipitated by ammonia from solutions of ferric chloride. The washed precipitate obtained from a known weight of pure iron wire was placed in a sp. gr. bottle (100 c.c.), together with distilled water, and after removing the air, the determination of the water displaced was made in the usual way. The observation was several times repeated under identical conditions, at intervals of 24 hours or more, with the following results:

(Calculated) weight of Fe_2O_3 employed, 0·4835 grm.
Wt. water displaced in first observation, 0·0580 ,,

After lapse of	Water displaced.	After lapse of	Water displaced.
1 day	0·0740	10 days	0·0435
2 days	0·0705	12 ,, ...	0·0710
3 ,, ...	0·0655	13 ,, ...	0·0615
5 ,, ...	0·0680	14 ,, ...	0·0675
6 ,, ...	0·0640	15 ,, ...	0·0695
7 ,, ...	0·0560	17 ,, ...	0·0655
8 ,, ...	0·0610	19 ,, ...	0·0715
9 ,, ...	0·0580		

(No account is taken of the water which has disappeared in combination.)

These results, while they defeated the attempt to ascertain the specific volume of ferric hydrate, by showing its extreme variability under apparently identical conditions, nevertheless bring out a fact which is worth consideration, and which indicates still more strongly the impossibility of arriving at this knowledge. The specific gravity of the hydrate we should expect to be the number expressing the ratio of the weight of $Fe_2O_3.xH_2O$ to that of the water which it displaces. Now, taking $x=2$, and the mean displacement observed, viz., 0·0644 grm., this ratio becomes 0·06527 : 0·0644, *i.e.*, 10. As an expression of the specific gravity of the hydrate this is clearly absurd. The question presents itself, what is the cause of this remarkable discrepancy between the volume of water actually displaced and that which we might, *a priori*, expect to occur? The explanation appears to me to be this: that the condition of precipitated hydrates is intermediate between that of solution and that of those immersed solids which we know to displace their own volume of the liquid in which they are placed.

This conclusion is borne out by a series of determinations, in which a paraffin was substituted for water in the sp. gr. flask, the hydrate having been previously washed with alcohol, ether, and the paraffin in succession. These yielded results identical with the preceding. Hence we must conclude that precipitated ferric oxide, even if it be a definite hydrate, does not occupy a constant and definite volume, and cannot be made the object of accurate volumetric observation. And the same conclusion probably holds good for the precipitated hydrates generally.

Another source of error which seems to have been overlooked by the writer, is the remarkable power which the oxides possess of retaining gases in a state of very intimate adhesion. Reichardt and Blumbritt (*Journ. Prakt. Chem.*, ii., 440—467) have carefully determined the extent of this retention of gases by hydrated ferric oxide. From the precipitated hydrate, after washing with hot water, they obtained a gaseous mixture of N, O, and CO_2, measuring 3½ times its volume, the presence of which could not be without material influence on the volume of the hydrate.

On the other hand, the volume, and therefore weight, of anhydrous oxides, such as the precipitated cupric oxide, is probably to be determined with accuracy by the proposed plan.

The condition of precipitation of the sulphides so closely resembles those of the oxides that we need not enter a discussion of its applicability to their estimation.

In those estimations which involve the precipitation of a metallic salt there seems to be some scope for the development or the gravi-volumetric method, if I may use the term (since the error due to variation in specific volume practically disappears), especially in such cases where the precipitated salt admits of being readily washed by decantation. A silver chloride determination, 2·9, would be very rapidly completed by effecting the pricipitation in the sp. gr. flask, agitating violently, washing twice or three times with water, and finally filling with water and weighing. Here however, a further source of error becomes evident, viz., that which lies in the high specific gravity of the compound under observation, for the error in the result is obviously the product of the specific gravity into the error of observation of the displaced water.

In those cases, where it would be necessary to resort to previous filtration, it becomes necessary to know the magnitude of the error due to the imperfect removal of the precipitate from the filter paper.

It is superfluous to enter into further discussion of a method which can only be judged by its results.

I append the result of a determination of silver, in the usual form of chloride, by this method. The whole operation of precipitation, washing by decantation, and estimation was conducted in the same flask, and completed in less than one hour.

Weight of water contained by specific gravity flask (at 15°) = 64·838 grms.
Weight of water + precipitate AgCl = 65·108.
Weight $AgNO_3$ taken = 0·422 grm., equivalent to 0·331 AgCl.
Let x = weight AgCl. Sp. gr. AgCl = 5·552 (Miller).
Then—

$$x\left(1-\frac{1}{5\cdot552}\right)=65\cdot108-64\cdot838.$$

$$\therefore x=\frac{0\cdot27}{0\cdot82}=0\cdot329 \text{ grm.}$$

0·329 = 99·4 per cent of the calulated weight.

Owen's College, March 18, 1878.

NOTES ON THE LOSS OF NITRE IN THE VITRIOL MANUFACTURE.

By GEORGE E. DAVIS.

THE arsenic trioxide which is formed by the combustion of pyrites is mostly stopped by acid running down the Glover's tower.

Some of the arsenic trioxide is converted into pentoxide by the nitrogen compounds, but the bulk remains in the acid, leaving the Glover tower as As_2O_3.

When the Glover tower acid is used for the absorbing tower the nitrogen trioxide oxidises, the arsenic trioxide becoming reduced itself to nitrogen dioxide, thus—

$$As_2O_3+(N_2O_3)_2=As_2O_5+(N_2O_2)_2.$$

Nitrogen dioxide is insoluble in oil of vitriol, hence the loss of nitre.

Further information will be given in future numbers.

Barton Arcade, Manchester,
March 12, 1878.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

March 16, 1878.

Professor W. G. ADAMS, President, in the Chair.

A SPECIAL General Meeting was held for the election, as an *ex-officio* honorary member of the Society, of the President of the Physical Society of Paris.

The following candidates were then elected members of the Society:—J. S. Bergheim, W. M. Hicks, M.A., Dr. J. Hopkinson, M.A., D.Sc., Miss E. Prance, and T. Wills.

The SECRETARY read a paper by Mr. W. J. MILLAR, C.E., "*On the Transmission of Vocal and Other Sounds by Wires.*" The author was led, mainly by a consideration of the manner in which sounds are conveyed through walls and partitions, to make an extensive series of experiments on this subject, from which he concludes that

conversation can be carried on at considerable distances by simply employing stretched wires provided with suitable vibrating discs. In one experiment two copper wires were attached to points on a telegraph wire 150 yards apart, and breathing, singing, &c., were distinctly audible; by stretched wires extending through a house and provided with mouth- and ear-pieces in the several rooms conversation could be carried on without difficulty. The materials employed for terminals were very varied, and the vibrating disc, whether metal, wood, india-rubber, &c., was generally formed as a drum head, the wire being fastened at its centre. The volume of sound appears to be greater with a heavy wire, but in all cases it requires to be stretched.

The PRESIDENT referred to the experiments of Wheatstone on the conduction of sound by vibrating bodies, especially long wooden rods. He mentioned that in 1856 a performance was given at the Polytechnic, at which numerous experiments connected with such conduction were exhibited. Some years ago M. Cornu, in conjunction with M. Mercadier, made experiments which showed that vibrations can be transmitted along a copper wire, and rendered visible at the distant end on a rotating blackened drum. The free end of the wire was attached to a piece of copper-foil fixed at its base, and provided with a point which left a clear trace on the drum when the distant end was attached to, say, a vibrating tuning-fork. By connecting such an arrangement with different instruments, and varying the players also, M. Cornu has ascertained the form and extent of vibration corresponding to each. The arrangement adopted by him was exhibited by Prof. Adams, and in conclusion he referred to a passage in Hooke's "Micrographia," which clearly showed that he was aware of the facility with which sounds can be transmitted to a distance by solid bodies.

Mr. W. H. PREECE described some experiments made in September of last year by Mr. A. W. Heaviside and Mr. Nixon at Newcastle-upon-Tyne on this subject, from which they conclude that the method might certainly be applied with success to the transmission of speech within a building. They find that a No. 4 wire gives the best results. The terminals were wooden discs about $\frac{1}{8}$th in. thick, and to these the wire was attached "end on," but speech could be distinctly heard by laying such a disc on any intermediate point of the wire. When the wire was particularly still speech was audible up to 200 yards.

Mr. G. W. von TUNZELMANN then read a paper on the "*Production of Thermo-electric Currents in Wires Subjected to Mechanical Strain.*" The wire of iron, steel, or copper was stretched vertically between two cans, which could be maintained at different temperatures. It was fixed in the base of the lower can, and held in the upper one by a clamp attached to the shorter arm of a lever, to the longer arm of which the stretching weight was applied. The free ends of the wire were joined to copper wires, which led to the Thomson galvanometer, these junctions being covered with cotton-wool. He has succeeded in reconciling the contradictory conclusions arrived at by Sir W. Thomson and M. Le Roux, for whereas the former only used moderate strains, the latter worked near the breaking limit, and the author finds that if the weight be gradually increased the direction of the current changes, and hence these two authorities found the currents to flow in opposite directions. A great number of experiments were made, and from them it is evident that on applying a strain the deflection does not immediately attain a maximum, but it gradually rises for about eight minutes and then gradually falls, attaining a stationary point at the end of about twelve minutes. Experiments in which the weight was rapidly put on and taken off led him to conclude that, besides the permanent, there is a transient effect produced by the strain, and this latter only he considers to be due to a change of molecular state.

Prof. ADAMS then exhibited a simple arrangement for projecting Lissajous's figures on to the screen, which has been made by his assistant, Mr. Furze. It consists of two strong straight steel springs, fixed in separate heavy iron frames, the one horizontally and the other vertically. The latter carries at its end a double convex lens, and the former carries a black disc perforated with a small hole, and is so mounted that its length may be varied as required. If now the disc be placed before the lamp and the point of light be focussed on the screen by means of the lens on the vertical spring, the two springs may be caused to vibrate, and the spot will describe a figure corresponding to their relative rates.

Prof. McLEOD referred to an analogous arrangement in which the spot and lens are replaced by two slits in black discs at right angles to each other.

Dr. GUTHRIE exhibited an experiment to show the behaviour of colloids and crystalloids in relation to electrolysis. A solution of gelatine was coloured with litmus, made acid, and mixed with sulphate of soda; two platinum poles of a six-cell Groves battery were then immersed in it, and the gelatine was allowed to set. The mass became comparatively clear round the positive pole and red and blue clouds were formed, which met across a space of about $1\frac{1}{2}$ inches in three-quarters of an hour. The relative advance of the ions was indicated by the brightening of the litmus round one pole and by the blue colouration produced at the other.

UNIVERSITY COLLEGE CHEMICAL AND PHYSICAL SOCIETY.

THIS Society has lately transacted the following business:—

Thursday, December 13, 1877.—Dr. C. A. Bell, Vice-President, in the chair. Paper on "*The Microscope and Accessory Apparatus*," by Mr. CHARLES J. WILSON.

Thursday, January 18, 1878.—Dr. Oliver J. Lodge, President, in the chair. Paper on "*Mechanical Illustrations of Electrical Phenomena*," by Dr. LODGE.

Thursday, January 31.—Dr. C. A. Bell, Vice-President, in the chair. Paper on "*Chemical Dynamics*," by Dr. BELL. Paper on "*Salt in Beer and Brewing Materials*," by Mr. H. BROWN.

Thursday, February 14.—Mr. R. H. Wright, Vice-President, in the chair. Paper on "*The Production of Thermo-Electric Currents in Wires Subjected to Mechanical Strain*," by G. W. von TUNZELMANN.

Thursday, February 28.—Mr. R. H. Wright, Vice-President, in the chair. Paper on "*The Study of the Physical Properties of Bodies in Connection with their Chemical Investigation*," by J. SAKURAI. Paper on "*The Manufacture of Oxalic Acid*," by CHARLES E. CASSAL (Hon. Sec.).

Thursday, March 14.—Mr. Harrison, B.Sc., in the chair. Paper on "*The Carbo-hydrates*," by FRANK L. TEED. Paper on "*Butter Analysis*," by Mr. H. ROBSON, B.Sc.

A paper on "The Transmission of Power by Water under Pressure" will be read by Mr. Paul Nolet, at the next meeting of the Society, to be held on Thursday, March 28, at 7 p.m.

NOTICES OF BOOKS.

Photographed Spectra: One Hundred and Thirty-Six Photographs of Metallic, Gaseous, and other Spectra, &c. By J. RAND CAPRON, F.R.A.S. London: E. and F. N. Spon. 1877.

MR. CAPRON has done good service to the science of spectroscopy in publishing this very beautifully executed series of photographic spectra. Photography is a most valuable handmaiden to spectroscopy in this respect, for the cleverest draughtsman, working with the most perfect

micrometer, cannot expect to rival the accuracy of a good photograph. Besides, these photographs may be enlarged within certain limits, and compared with one another at leisure, so as to reduce the chances of error to a minimum. The plates are 136 in number, exclusive of a supplementary plate of the solar spectrum showing Rutherford's bright oxygen lines. The spectra include those of most of the heavy metals, the elementary gases, and several compounds, such as silicic fluoride, tri-chloride, coal gas, olefiant gas, &c. The spectroscope employed for the metals is a direct vision 5-prism instrument, dividing the D lines easily with a low eyepiece. It was fitted to an ordinary camera, the telescope and eyepiece being replaced by a projecting lens of 9 inches focus. It seems a pity, by the way, that such a very rough sketch of this apparatus should have been given. Although intelligible to the practised spectroscopist, we fear it will only puzzle the ordinary student to make head or tail of it. The metallic spectra were obtained both from the spark and the electric arc, a Ruhmkorff coil with condenser giving a very brilliant $\frac{1}{4}$ to $\frac{1}{2}$ an inch spark being used for the former purpose, and 40 pint Grove cells for the latter. Mr. Capron has confined his researches more especially to the violet end of the spectrum, ranging from about E or *b* to H_1 or H_2 in the violet. The exposure for the spark spectra averaged about fifteen minutes, the arc spectra, which were very bright, from three to five minutes. The images in the camera were two inches long, the plates being afterwards enlarged to double that size. For the gaseous spectra, three different instruments were used—one similar to that used for the metallic spectra; a spectroscope with two quartz prisms, the collimating and projecting lenses being also of quartz; and, lastly, an instrument constructed with the special view of photographing faint spectra. The impressions from this instrument are quite small, being less than half an inch in length, but so extremely sharp that they will bear enlarging nine or ten times without loss of definition. The spectra obtained from the metals are mostly very beautiful, especially those of Cu (arc), Di, Er, Fe (arc), meteorite (arc), Ag (arc), Tl (arc), Ti (arc) and Va (arc).

A description of each print is given in the text, stating how the spectrum was obtained, and other interesting details.

The gaseous spectra were not so successful on the whole, bromine and chlorine refusing to give any spectra at all, the tubes breaking down before they had been lighted a sufficient time to give an image. With iodine vapour Mr. Capron was more successful. No doubt these difficulties will be overcome in time, and that before long we shall have photographic spectra of all the gases as well defined as those of N, NH_3, and coal gas.

The photographs have been very beautifully reproduced in permanent colour by the Autotype Company.

Although far from being a perfect work, from causes at present beyond the author's control, it cannot fail to be of great service to all classes of spectroscopic observers.

Year-Book of Pharmacy, comprising Abstracts of Papers Relating to Pharmacy, &c., contributed to British and Foreign Journals from July 1, 1876, to June 30, 1877. London: J. and A. Churchill. 1877.

The year ending June 30th, 1877, was comparatively fruitless in great pharmaceutical events interesting either to the scientific chemist or the pharmacist. It has not, however, been wanting in research, and the papers of Messrs. Wright, Groves, Williams, Paul, and Kingzett (on the alkaloids contained in *Aconitum napellus* and *Aconitum ferox*), are models of what such researches should be. The so-called aconitine of commerce, which was at one time thought to be the pure alkaloid, contains a mixture of three distinct alkaloids—pure aconitine, a highly active crystallisable body, and giving crystallisable salts; pseudaconitine, also highly active and crystallisable, but not readily yielding crystallisable compounds; and an amorphous, bitter, physiologically inert base, picraconitine, furnishing well crystallised salts. So far the alkaloids contained in *A. napellus*. *A. ferox*, the Japanese variety of the plant, contains a much larger proportion of pseudaconitine and a much smaller one of aconite than its European congener. It also contains a fourth alkaloik, according to Messrs. Paul and Kingzett; but Dr. Wright looks on this body as pseudaconitine and mixed decomposition products thereof. This part of the subject, however, is at present under investigation. The other chemico-pharmaceutical researches contained in this volume are of comparatively small scientific interest.

Amongst the papers read before the Pharmaceutical Conference at Plymouth, those on the aconite alkaloids undoubtedly bore off the palm; but there are others of great merit. It seems, however, to be a pity that certain members of the Conference should take up subjects for investigation which do not in any way concern pharmacy proper. We allude to such papers as those on "Oil of Sage," "Hederic Acid," "The Proximate Principles of Narcissus," and several others. Such subjects as these not only properly belong to the domain of the scientific chemist, but, as far as one can see at present, they are not in the slightest degree connected with pharmacy. With so many urgent pharmaceutical questions crying out for investigation, it seems worse than a waste of time to encroach on ground already occupied.

Proceedings of the Twenty-fifth Annual Meeting of the American Pharmaceutical Association held at Toronto, Canada, September, 1877. Philadelphia: Sherman and Co. 1878.

The American Pharmaceutical Association met for the first time last year over the border of the United States, their twenty-fifth annual meeting being held on British territory at Toronto, Upper Canada. In looking through the list of papers read at the meeting, one cannot help being struck with their practical character as compared with those read before our own Pharmaceutical Conference. There is not a single one which does not more or less elucidate some important point in practical pharmacy. Here we find no *dilettante* reseaches into esoteric questions: every paper has its practical purpose and bearing. We should advise the younger and more ambitious members of our own Pharmaceutical Conference, many of whom seem to prefer chemistry to pharmacy, to study the list of questions given out to the members of the American Association for investigation; out of the whole fifty-six there is not one which is not intimately connected with the every-day work of the practical pharmacist. One of the most interesting chemical papers is that by Mr. H. S. Wellcome, of New York, on "The Bromine Production of the United States. From this paper we learn that the production of bromine in the United States has now reached 1000 lbs. a day, but the amount of raw material, waste bittern, available for producing this element would yield three times that quantity. The principal salt works which produce bromine in the United States are four in number, and are situated in Western Virginia and Ohio, the largest manufactures being Herman Lemer, of Mason City. The Ohio and Kanawha salt region produces bittern which is twice as rich in bromine as any other yet discovered. Singularly enough the Syracuse and other New York and Western bitterns do not contain a trace of bromine. Owing to the high price of bromine in Europe several lots were exported last year, in all about 50.000 lbs. As no steamship will carry bromine, and as it is very difficult to induce other vessels to take it at any price, it is only under exceptional circumstances that American bromine appears in the European market.

Next year the meeting of the Association will be held in Atlanta, in Georgia. Strangely enough, this will be the first time that the Association has met in any of the Southern States, where it is said that pharmacy is at a very low ebb.

English pharmacists will do well to study this volume, not merely for the sake of the information it contains, but in order to learn how a Pharmaceutical Association having precisely the same objects as their own should be carried on.

The active members of the Association number over 1000.

CORRESPONDENCE.

ON THE APPLICATION OF SONSTADT'S SOLUTION TO THE SEPARATION OF MINERALS FOR CHEMICAL ANALYSIS.

To the Editor of the Chemical News.

Sir,—Mr. Hardman, in his paper in your last number, on "The Application of Sonstadt's Solution to the Separation of Minerals for Chemical Analysis," claims, I think, more than is quite fair when he writes of his own application of the liquid to such a purpose as "perhaps the first."

Just four years ago, my "Note on a New Method of Taking Specific Gravities, Adapted for Special Cases," appeared in your journal; and in that paper I gave an illustration of the bearing of the method upon analysis by describing how impurities in certain alkali salts could be quickly and with certainty detected by its means. I stated also that I had "found the method very convenient . . . . whenever wanting to know the sp. gr. of any mineral not so heavy as to sink in such a liquid as could be conveniently made and used."

After describing how iodide of ethyl may be used for substances of less sp. gr. than 2·0, I go on to describe the liquid to which Professor Church has done me the honour to attach my name, and state that I had tested "many minerals by it." In the last two paragraphs of my paper I especially point out that different minerals may readily be thus distinguished. Taking quartz as an example of a mineral from which others are to be distinguished, the words in the paper are "As many minerals closely resemble quartz in external characters, *and can be distinguished more readily by their specific gravity than in any other way, this method of testing the specific gravity furnishes a very quick and certain means of discrimination.*" In the last paragraph I suggest, further, that gems may by this liquid be separated from quartz sand. Long before writing my paper, I had used the liquid in the examination of residues from chemical processes, and for discriminating minerals from the matrix in which they were bedded, but I thought it unnecessary to specify every case in which the liquid might be applied, all such applications following naturally when once it was pointed out how readily minerals differing in sp. gr. might be distinguished.

Mr. Hardman refers to Professor Church as having "noted the applicability Sonstadt's solution to the separation of minerals," &c. I think I may fairly claim to have shown this applicability in my original paper; and I must do Prof. Church the justice to say that he gave me my due when, in describing the identification of gems by this method in a paper published in the *Quarterly Journal of Science*, he, in a foot-note, writes, "as proposed by Mr. Sonstadt," or words to that effect.

Although I am glad to find that the utility of the method proposed by me for separating substances of different specific gravity is begining to be recognised, yet it seems that one application of a heavy liquid that I suggested and referred to examples of, remains neglected—I refer to the different specific gravity of different parts of crystals which becomes apparent when they are suspended without weight.

In my paper I specify crystals of chloride of potassium, which, when prolonged on one axis, have one end specifically heavier than the other. I found crystals of alum always to have a heavy side, and it seems probable that experiments on a variety of crystals of different substances would lead to interesting results. Clearly it would be possible so to *weight* the lighter end or side of a crystal as to make a quantitative determination of the difference of specific gravity between different parts possible.—I am, &c.,

E. Sonstadt.

75, Churchill Road, N.W., March 18, 1878.

THE CHEMICAL PROFESSION IN AUSTRALIA

To the Editor of the Chemical News.

Sir,—I was very pleased to learn from an October number of the Chemical News, that the long correspondence which took place in your columns on the necessity of an organisation among chemists had resulted in the formation of "The Institute of Professional Chemists of Great Britain and Ireland."

I would, on behalf of the few qualified chemists who have had the misfortune to cast their lot in this and other colonies, ask the new association to extend its arm of protection to Australia and New Zealand.

So far as Victoria—the most prosperous of the Australian colonies—is concerned, I can state that the quack element has so degraded the profession that several trained chemists, one of whom is a B.Sc., have, through sheer necessity, had to accept common clerkships.

During the two years I have been lecturing in this country I have urged upon the Government the desirability of encouraging the study of the physical sciences, and more especially of chemistry, and from what I learn it is more than likely that it will do so.

In order, therefore, that the colonial public may have reliable analysts and lecturers, I would ask the Institute to extend its influence to the British colonies, and more especially to Australia.

Unless he comes out under engagement, a chemist has, in the present state of affairs, a very black look out indeed.—I am, &c.,

R. W. Emerson MacIvor,
F.C.S., Memb. Phys. Soc., &c.

Chemical Laboratory, 29, Queen-street, Melbourne.
Jan. 8, 1877.

CHEMISTS AND CHEMISTS.

To the Editor of the Chemical News.

Sir,—I am sorry Professor Attfield has not taken in good part my well-meant endeavour to sustain him in what, but for the robustness of my faith in his authority, I should now begin to fear was an untenable position. Very little was requested of him, nothing but what he might have supplied to the humblest of inquirers. Not an elaborate letter, not even a citation of extracts was asked for, but only, and for the benefit of your anonymous readers whom he had himself volunteered to enlighten, a reference to the particular passages or records on the strength of which he had put forth certain historic statements of quite exceptional interest. But, instead, he shrouds himself in his dignity,

> "As who should say, 'I am Sir Oracle,
> And when I ope my lips, let no dog bark.'"

I have little doubt, however, that Professor Attfield—and this time I will be very respectful, my former unlucky reference to "my friend, Professor Attfield," seeming to be considered a liberty, although, indeed, he and I have known each other many years, and my signature is, I believe, attached to his Royal Society certificate—I have little doubt, I say, that Professor Attfield has an excellent reason for his present reticence, and a better reason consequently than the one he has put forward. For myself, as still retaining the conviction, though just a little

shaken, that the designation of chemist pertains only secondarily to the student and worker, and primarily and distinctively to the dealer in chemicals, I again venture to subscribe myself as your obedient servant,

A Credulous Chemist.

London, March 19, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 7, February 18, 1878.

Refutation of the Criticisms which M. Pasteur has Published on my Opinions Concerning the Origin of Ferments, Alcoholic and Lactic.—A. Trecul.—A controversial paper of little general interest.

The Vibrations of Matter and the Waves of the Ether in Sight.—M. Favé.—If we admit that all matter is endowed with a system of persistent vibrations, we are led to consider vision in a new light for the transparent cornea, the aqueous, the crystalline, and the vitreous humour can be no longer regarded simply as concerns the refraction which they produce. It must be admitted that the vitreous humour exerts all the vibrations to be communicated to the optic nerves, and that these are able to select the vibrations which they are capable of executing to produce distinctly the sensation which remains an insoluble problem. By admitting that the waves of the ether communicate their motion to the synchronous vibrations of different parts of the eye we may refer to physics certain facts hitherto considered as purely physiological. The eye if closed for a time, sufficiently long not to experience any sensation of light, undergoes, nevertheless, the constitutive vibrations of its component matters, but in this state the vitreous humour does not impart to the nerves a *vis viva* sufficient to produce sensation. The eye, again, is opened and receives waves capable of augmenting certain vibrations of the vitreous humour, but time is required in order that the vibration may acquire the needful intensity. If the minimum intensity indispensable for sensation has been excceded and the eye is again closed the sensation does not cease immediately, for the *vis viva* aquired must first be transferred to the ether.

Presence of Magnetic Globules Analogous to those of Atmospheric Dust in Rocks Belonging to Ancient Geological Epochs.—MM. Meunier and Tissandier.—The facts observed by the authors show that the present sediments of the sea, like those of the geological oceans, contain globules like those which the atmosphere constantly lets fall upon the surface of the earth.

Separation of the Non-ferruginous Components of Rocks, Founded on their Difference in Specific Gravity.—M. Thoulet.—The specific gravity of the majority of the essential minerals of rocks varies between 2·2 and 3. Hence, to separate these minerals from each other, they may be immersed in a solution without chemical action upon them, and whose specific gravity is comprised between the same limits. For this purpose a solution of iodide of mercury in iodide of potassium saturated at 11° may be used, as its sp. gr. is 2·77.

The Telephone of Bell and the String Telephone.—A. Breguet.—The author has examined the influence of the thickness of the iron plates upon the reception of sound by Bell's telephone, and finds that it has no limits

On Telephony.—G. Salet.—The general problem of telephony, the transmission of speech to a distance, seems at first to be identical with this: to render the movements of a membrane connected with those of another membrane situated at a great distance in such a manner that to every displacement of the former a displacement of the latter, proportional and in the same direction, may correspond.

Ebullition of Superposed Liquids.—D. Gernez.—In a vacuum a mixture of two liquids without chemical action upon each other emits vapours whose tension is almost rigorously equal to the sum of the maximum tensions of the two vapours at the same temperature.

Extraction of Gallium.—Lecoq de Boisbaudran and E. Jungfleisch.—The small proportion of gallium in the minerals containing it renders the preparation of this metal costly and laborious. The authors have followed a method which enables them to attach its preparation to that of a commercial product, the sulphate of zinc, and to operate at first industrially upon important masses. M. Leon Thomas has under their guidance treated 4300 kilos. of the blende of Bensberg, the richest ore known. The pulverised mineral is roasted in a Perret furnace, when the gallium remains fixed, while the greater part of the indium is volatilised. The residue is treated with a quantity of sulphuric acid sufficient to dissolve almost all the zinc, leaving, however, in the mass so much subsulphate of this mineral that the filtrate may be rendered turbid by cold water. We obtain thus, commercial sulphate of zinc and a residue containing the gallium. This residue is re-dissolved in an excess of sulphuric acid. After the reduction of the per-salt of iron by means of metallic zinc, the filtrate is precipitated fractionally with carbonate of soda, the progress of the operation being watched with the spectroscope. The precipitates are re-dissolved in sulphuric acid, and a second reduction with zinc and a fractionated precipitation with carbonate of soda follow. All the gallium in the 4300 kilos. of ore was thus concentrated in about 100 kilos. of still moist material. To remove the iron the reductions with zinc and the fractionated precipitations with carbonate of soda are repeated several times. The galliferous precipitate is re-dissolved in sulphuric acid, evaporated to the elimination of most of the excess of acid, and boiled with much water. The filtrate deposits a sediment containing titanic acid. The liquid, which is very acid and much charged with zinc, is treated with sulphuretted hydrogen, mixed with acetate of ammonia, and anew treated with sulphuretted hydrogen. Sulphide of zinc is thrown down along with gallium, which is thus freed from alumina. The additions of sulphate of zinc, of acetate of ammonia, and the currents of sulphuretted hydrogen are repeated as long as the sulphide gives the rays of gallium. The sulphuric solution of the galliferous sulphides of zinc is carefully fractionated with carbonate of soda, and guided by spectral examination the zinc is thus exactly separated. Being again dissolved in sulphuric acid in the quantity exactly necessary we further separate with sulphuretted hydrogen a little cadmium, lead, indium, zinc, &c., and the liquid, largely diluted with water, is raised to a boil. By filtering when hot we collect a bulky sub-salt of gallium which is immediately washed in boiling water, for on cooling it dissolves in its mother-liquor. This basic salt is very readily attacked by potassa, which leaves undissolved iron, indium, &c. The alkaline liquor on treatment with sulphuretted hydrogen gas, and then very slight acidulation with sulphuric acid, yields a deposit principally consisting of sulphide of indium. The very slightly acid liquid is next boiled with a large excess of water, when the sub-salt is again deposited. Metallic gallium is isolated by the electrolysis of the potassic solution of the sub-salt. The metallic deposit is only obtained advantageously under certain special conditions. The intensity of the electric current should vary according to the state of the liquid, but the surface of the negative electrode must be small in comparison with that of the positive electrode. If the metal is deposited in the cold it often forms long rows of crystals resembling needles fixed to the electrode by one

of their ends, and sometimes reaching 3 centimetres in length. Above 30° the metal flows in drops, which collect at the bottom of the electrode. The crude metal has been further purified by filtering it through dense linen, shaking it while hot with water acidulated with hydrochloric acid and repeated re-crystallisation.

Volumetric Method of Determining Potassa.—A. Carnot.—This method is a transformation of that made known by the author in the *Comptes Rendus* for July 31 and August 7, 1876, and June 25 and July 30, 1877, depending on the precipitation of the double hyposulphite of potassa and bismuth in an alcoholic solution. The new method consists in determining, by means of a standard solution of iodine, the proportion of hyposulphurous acid in an aqueous solution of the same salt. The iodine solution employed is decinormal, as recommended by Prof. Mohr; 12·7 grms. of pure iodine being dissolved in water by the aid of about 18 grms. of potassium iodide, and the solution made up to 1 litre. The solution of calcium hyposulphite contains, per litre, 200 grms. of the crystalline salt. The solution of bismuth contains per litre about 100 grms. sub-nitrate, and a sufficient proportion of hydrochloric acid and alcohol. For each operation 1 grm. of the salt to be analysed is taken, or a quantity which may contain at most 70 centigrms. potassa, and it is dissolved in about 10 c.c. of water. If the salt contains much sulphate, chloride of calcium is added (1 grm. of this salt dissolved in water, or a corresponding quantity of pure calcium carbonate dissolved in hydrochloric acid is fully sufficient for 1 grm. of sulphate), and the mixture is left for a few minutes in order that the calcium sulphate may have time to precipitate. Into the same flask are poured successively 10 or 20 c.c. of the solution of bismuth, according as the quantity of potassa is presumably below or above 30 centigrms.; an equal volume of the hyposulphite of lime is next added, and, lastly, from 100 to 150 c.c. of concentrated alcohol. The whole is well stirred up and left to settle for a quarter of an hour. The precipitate of double hyposulphite, whether mixed with sulphate of lime or not, is collected on a filter and carefully washed with alcohol. The funnel is then set over a flat-bottomed flask and cold water is poured upon it with the washing bottle, when the hyposulphite dissolves rapidly. The portion of calcium sulphate which may dissolve at the same time does not interfere with the subsequent operations. A little clear starch paste is then added to the solution, and a few c.c. of hydrochloric acid. The standard iodine liquid is then added with a burette until a deep brown tint appears in the liquid. The volume of the iodine solution employed is then read off, and the weight of the potassa is thence calculated.

Dissociation of the Hydrate of Chlorine.—M. Isambert.—The author has undertaken to measure by direct experiment the tension of the chlorine given off by the hydrate at different temperatures.

Action of Chloride of Benzoyl upon Leucin.—A. Destrem.—The products are $C_{12}H_{24}N_2O_3$, a white amorphous powder, and $C_{26}H_{32}N_2O_5$, a yellow amorphous body very soluble in alcohol.

Identity of Muscular Inosite and the Vegetable Sugars of the same Composition.—MM. Tauret and Villiers.—Inosite is a sugar very widely distributed in nature. A sugar of the same composition has been found in peas, green lentils, acacia cabbage, digitalis, potatoes, asparagus, and two cryptogamous plants.

Preparation of Amylen.—A. Etard.—If a mixture of the alcohols of fermentation is treated with chloride of zinc the result comprises much amylen and little of its polymers.

Experimental Researches on the Maturation of Grapes.—C. Saint Pierre and L. Magniers.—Grapes when ripening evolve carbonic acid, whether in the dark or on exposure to light.—This disengagement takes place in inert gases as well as in the air. The quantity of carbonic acid produced is always greater than the quantity of oxygen consumed. Grapes are capable of absorbing or of losing water, according as they are kept in a damp or a dry locality. As the ripening advances the acids diminish and the sugar augments. The mechanism of ripening is as follows:—The acids and the glucose are formed in the plant and the sap conducts them to the fruit. The acids are burnt there, while the sugar is concentrated. When the ripening process is very far advanced the sugar is burnt in its turn.

No. 8, February 25, 1878.

Carburation of Nickel by the Cementation Process.—M. Boussingault.—Nickel, like iron, is magnetic, sufficiently ductile to be forged and drawn into slender wire. Its point of fusion is very high, and if melted in a *brasqué* crucible it yields a homogeneous regulus of a silvery whiteness, containing carbon. The author has examined whether nickel, like iron, when carburetted, is capable of being tempered and acquires elasticity, and whether it renders steel less susceptible of oxidation. The result was decidedly negative, except that alloys of iron or steel with large proportions of nickel, 30 per cent and upwards, resist the oxidising action of air and water.

New Product of the Oxidation of Lead, and Certain Phenomena of Dissociation.—H. Debray.—There exists a sesquioxide of lead, or rather a compound of plumbic acid and protoxide of lead in equal equivalents, quiet distinct from the sesquioxide, commonly so-called, which is merely a mixture. The sesquioxide of lead is not decomposed by the influence of heat, as is the general case with direct compounds, like the carbonate of lime. Such bodies, if heated in a limited space at a temperature where their decomposition begins, cease to be decomposed when the temperature of the gas evolved in the apparatus has acquired a certain value depending solely on this temperature. But the sesquioxide of lead is split up into oxygen and minium, which, at least in the circumstances indicated above, is not capable of re-oxidation. The sesquioxide, therefore, under the influence of heat behaves like lead carbonate, or any other indirect compound.

The Battery Telephone.—Th. du Moncel.—Experience shows, contrary to what might be *a priori* imagined, that the telephone of Bell with induced currents is more sensitive at a distance than those with a battery. This inferiority may perhaps be ascribed to the alteration of the contacts of the transmitting telephone by the spark of the galvanic current. If, on employing for the transmitting telephone, the plumbago system of Edison, and for the recipient the system of Bell, we pass the galvanic current across the inductive helix of a Ruhmkorff's apparatus, the induced wire of which is connected with the coil of the receiving telephone, the latter, which may have produced no sound under the mere influence of the galvanic current, may, nevertheless, yield very distinct sounds under the influence of the induced currents derived from the former, and the effects occasioned by the galvanic currents may thus be reinforced phonetically.

The Vibrations of Matter and the Waves of the Ether in the Act of Ebullition.—M. Favé.—The author, referring to Gay-Lussac's observation that water boils at a higher temperature in a glass vessel than in one of metal, and to his suggestion to prevent succussions in the distillation of sulphuric acid by putting fragments of platinum wire in the retort, states that he is in a position to explain these facts. The wave-lengths of the solar spectrum vary from 220 to 4800 millionths of a millimetre. Each of the vibrations of matter which gives rise to these waves possesses a certain quantity of *vis viva* which is manifested by the effect of heat, only this heat is sometimes too small to be recognised by our instruments. In the solar spectrum the thermic action increases from its minimum in the violet to a certain distance beyond the red, after which it declines to a point where it disappears entirely. Thus the *vis viva* of the solar vibrations in-

creases with their duration up to a maximum, after which it decreases. Hence, a distinction must be made between vibrations whose lengths differ, for two dissimilar substances cannot always communicate to each other all their excess of heat. From the fact that the ebullition of water is effected in an iron vessel and in a glass vessel we may infer that both transmit to the water all the vibrations necessary to form its vapour, but if the ebullition takes place at a higher temperature in the glass than in the metal it is because the glass requires a more elevated temperature than the tin plate to be in a condition to give to all the vibrations indispensable for watery vapour the necessary intensity. The system of the vibrations of the source of heat, if it is not in harmony with that of the vibrations of the vessel, may also retard ebullition. To these two causes it must be ascribed that ether, which over the naked fire boils at 44°, has been raised to 65° in the water-bath.

Certain Consequences of the Constitution of the Solar Spectrum.—A. Cornu.—The author has been led to the conclusion that the position and relative brightness of the dark rays of the solar spectrum may be explained by the action of an absorbent stratum existing upon the sun, analogous in its chemical composition to that of volatilised aërolites. He infers also that the centre of the earth consists chiefly of metallic masses, and especially of iron.

Transient Variation of Permanent Magnetism.—J. M. Gaugain.—The transient variation of a bar is positive when the bar has been magnetised at a temperature of about 350° and negative when the magnetisation has been performed at any temperature not exceeding 100°. The temperature at which the transient variation = 0 varies in different bars of steel.

Action of Boron Fluoride upon Organic Substances.—Fr. Landolph.—On treating ordinary camphor with boron fluoride the author obtained as results of the reaction cymene and certain of its polymers and two carbides of the series C_nH_{2n-2}. The gases given off are boron fluoride, carbonic oxide, ethylen, and propylen. Acetylen and carbonic acid are absent.

Transformation of the Bromated Hydrocarbides of the Ethylen Series into Bromides of the Acids of the Fatty Series by the Simple Addition of Oxygen.—E. Demole.—The author caused dry oxygen gas to react upon dibromated ethylen at an ordinary temperature. The addition product thus obtained is not dibromated oxide of ethylen, but bromide of bromacetyl.

Analysis of the Sulphurous Mineral Waters of Aix in Savoy and of Marlioz.—E. Willm.

Action of Oxygen upon the Anatomic Elements.—P. Bert.—The injurious influence of oxygen upon air-breathing vertebrates begins to be manifested at 5 or 6 atmospheres. The analysis of the gases contained in the blood shows that at this tension, the colouring-matter of the blood-globules being completely saturated with oxygen, this gas begins to dissolve in the plasma. If the duration of the compression is prolonged the solution of oxygen in the tissues becomes general, when a diminution of organic oxidation appears with its most immediate consequence, a fall of the temperature of the body.

Lactic Fermentation of Milk-Sugar.—Ch. Richet.—If milk is placed in a stove heated to 40° it becomes acid, coagulates, and after a time aquires an acidity of 1·6 of lactic acid in 100 parts of milk. This limit is never exceeded. If a few drops of a mineral acid are added to fresh milk the fermentation is completely checked and no further acidity is developed. But if, instead of a mineral acid, we add acid gastric juice the lactic fermentation is developed with extraordinary rapidity, and the milk reaches in four or five days an acidity equal to 4 per cent of lactic acid. The fermentation is arrested in presence of a large quantity of phenol, but unless there is sufficient of this reagent to remain in part undissolved in the liquid the fermentation is merely delayed

MISCELLANEOUS.

How History is Written!—The *Times* of the 21st inst. contains the following paragraph in its telegraphic letter from Paris :—"M. Lamy, the distinguished chemist, and discoverer of the metal thallium, died to-day."

The Chemical Society.—We have often inserted communications respecting the value of the Fellowship of the Chemical Society. For the sake of those who are interested in the question we insert the following extract from the *Chatham News* of February 17, 1878 :—"Mr. W. Watson, Chemist, Rochester, has had a great honour conferred upon him by being elected a Fellow of the Chemical Society—a degree that may be considered the highest to attain in chemistry. When Mr. Watson sees his name associated with those men of such eminence as Professors Redwood, Attfield, Tyndall, Richardson, Abel, &c., we should say he must feel proud of the distinction. We believe there are but ten in Kent who have obtained the degree of F.C.S.

Russian Scientific News.—M. D. Latchinoff has tried some experiments with the telephone. He measured the resistance of coils and the magnetic moments of five instruments :—

	No. of Telephone.				
	1.	2.	3.	4.	5.
Resistance (Siemens units) ..	34	42	24	55	45
Position of the magnetic needle	45°	58°	51°	34°	45°

M. Latchinoff thinks that the vibrations of the plate in telephones has a different character from the vibrations producing Chladni's figures. The introduction of a feeble current into the telephone coil has no apparent action on the sound.

M. Slouginoff, in using during the electrolysis of H_2SO_4 an aluminium plate for anode, remarked the formation of a solid precipitate of alumina on the surface of the plate. The precipitate is remarkably solid, will scratch glass, and cannot be rubbed off even by emery powder. Alkalies and acids have a very feeble action on it. On a polished aluminium plate the alumina galvanically precipitated gives beautiful Nobili's rings.

M. N. Lubavin has examined the compounds of lactic nouclein. It appears that this substance is not the phosphoric salt of casein, but only contains a certain compound of phosphoric acid. Nouclein has the properties of a feeble acid. Its lead salt is especially remarkable, being a very constant compound; this salt contains for two equivalents of phosphorus always three equivalents of lead, even when it was obtained from differently prepared nouclein.

M. Barsilowsky has prepared meta-azotoluol in the form of orange crystals (melting-point 54°).

SERGIUS KERN.

St. Petersburg.

NOTES AND QUERIES.

Filling for Millstones.—In looking over a paper devoted to the milling interest I notice a letter from one of its correspondents referring to a note which appeared in a previous issue on "Lead Poisoning from Millstones." This correspondent states that *he* never uses lead for fixing cross-bars in millstones, knowing it to be poisonous. He recommends alum to be used, as he "has never known it to get loose." Some years ago, through the medium of your valuable journal, I drew attention to the practice of millers filling up the fractures, &c., in the millstones with a composition of alum and plaster of Paris; these were melted together and run whilst hot into the cracks in the stones; the individual above named "melts the alum and runs it into the stone the same way as lead." He knows that lead is poisonous, but he does not say what he knows of alum when it is introduced into the system. Does not the above give food for reflection.—J. H. SWINDELLS.

Falsification of "Scotch Soda."—A short time ago I had brought under my notice a quantity of crystals sold to oil-shops, &c., as Scotch washing-soda. They proved to be sulphate of soda with a *little variation*, and it may interest some of your readers to know that a considerable quantity of these crystals are being made and disposed of in London. I know four makers who are turning out upwards of

50 tons per week of this article, the whole of which is sold and consumed in London. The method of making this so-called Scotch or "Bastard" soda is as follows. Salt-cake or nitre-cake, &c., is dissolved in water until it has a specific gravity of 1·250, and the acid neutralised with milk of lime so that it will not act upon litmus paper; then, for every 100 lbs. of whatever cake is used 15 lbs. of soda-ash is dissolved in as small a quantity of water as possible—say to 1·350 sp. gr. or 70° T.—and, added to the other liquor, the whole is then well boiled up, allowed to settle, and run into iron pans, which must be clean and free from rust of iron. After crystallisation has finished, the mother-liquor is drawn off, and the crystals, a solid and compact mass, removed, broken up, and allowed to drain well, and then packed in casks for the market.—J. H. SWINDELLS.

MEETINGS FOR THE WEEK.

MONDAY, 25th.—Medical, 8.30.
—— London Institution, 5.
—— Royal Geographical, 8.30.
—— Society of Arts, 8. "The Application of Photography to the Production of Printing Surfaces and Pictures in Pigment," T. Bolas, F.C.S.

TUESDAY 26th.—Civil Engineers, 8.
—— Royal Institution, 3. "Protoplasmic Theory of Life, and its Bearing on Physiology," Professor Garrod.
—— Anthropological, 8.

WEDNESDAY, 27th.—Society of Arts, 8. "State Aid to Music at Home and Abroad," Mr. Alan S. Cole.

THURSDAY, 28th.—Royal, 8.30.
—— Royal Institution, 3. "Chemistry of the Organic World," Prof. Dewar.
—— London Institution, 7.
—— Society of Arts, 8. (Chemical Section). "Electric Lighting," Dr. Paget Higgs.

FRIDAY 29th.—Royal Institution, 8. Weekly Meeting. "Chemical Actions of Light, and their Electrical Relations," Prof. Dewar, 9.
—— Society of Arts, 8. (Indian Section). "The Depreciation of the Value of Silver, with essecial reference to the Exchange between India and England, and Suggestions for a Remedy," Col. J. T. Smith, R.E.

SATURDAY, 30th.—Royal Institution, 3. "Gleanings from the Natural History of the Ancients," Rev. W. Houghton.
—— Chemical, 8. (Anniversary).
Physical, 3. "Byrne's Pneumatic Battery," Mr. W. H. Preece.

ERRATUM.—P. 98, col. 2, line 8 from top, *for* "by the addition or abstraction of oxygen," *read* "by the action of oxidising on reducing agents."

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 22, Albemarle Street, W.—The NEXT ANNUAL GENERAL MEETING will be held at DUBLIN, commencing on WEDESDAY, August 14.

President-Elect.
W. SPOTTISWOODE, Esq., LL.D., F.R.S., F.R.A.S., F.R.G.S.

NOTICE to CONTRIBUTORS of MEMOIRS.—Authors are reminded that, under an arrangement dating from 1871, the acceptance of Memoirs, and the days on which they are to be read, are now, as far as possible, determined by Organising Committees for the several Sections before the beginning of the Meeting. It has therefore become necessary, in order to give an opportunity to the Committees of doing justice to the several Communications, that each Author should prepare an Abstract of his Memoir, of a length suitable for insertion in the published Transactions of the Association, and that he should send it, together with the original Memoir, by book-post, on or before August 1, addressed thus:—"General Secretaries, British Association, 22, Albemarle Street, London, W. For Section ....." If it should be inconvenient to the Author that his Paper should be read on any particular day, he is requested to send information thereof to the Secretaries in a separate note.

G. GRIFFITH, M.A.,
Assistant-General Secretary, Harrow.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing are Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for udents, Schools, Colleges, &c.
NEW PATTERNS OF GEOLOGICAL HAMMERS.
EW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
83, CHARLOTTE STREET, FITZROY SQUARE.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

SEVENTH EDITION, BY ROBERT HUNT, F.R.S.
In Three Volumes, medium 8vo., with above 2000 Woodcuts, price £5 5s. cloth, or £6 6s. half-bound in russia.

URE'S DICTIONARY OF ARTS, MANUFACTURES, and MINES, containing a Clear Exposition of their Principles and Practice. Seventh Edition, re-written and enlarged. Edited by ROBERT HUNT, F.R.S., Keeper of Mining Records; assisted by numerous Contributors eminent in Science and familiar with Manufactures.

"The great point in a Dictionary like Dr. Ure's is to include all that is really essential without rendering the result too bulky, and consequently too costly. This end, we think, the Editor and his staff of eminent Contributors have reached to a very satisfactory degree. The Seventh Edition is a book which no manufacturer, merchant, miner, or technologist should be without."—*Quarterly Journal of Science.*

London: LONGMANS and CO.

Just published, in 8vo., price 12s., cloth,

ANTHRACEN: its Constitution, Properties, Manufacture, and Derivatives, including Artificial Alizarin, Anthrapurpurin, &c., with their Applications in Dyeing and Printing. By G. AUERBACH. Translated, with the Author's co-operation, by W. CROOKES, F.R.S., Vice-President of the Chemical Society.

"Few have had more experience both in the laboratory and in the manufacture of anthracen derivatives, especial y artificial alizarin, than Mr. Auerbach; so that a more reliable work for all engaged in the manufacture and use of artificial colouring matters could not be wished for."—*Mining Journal.*

London: LONGMANS and CO.

Mr. WATTS'S DICTIONARY OF CHEMISTRY
Complete in 7 vols., medium 8vo., price £10 16s. 6d.

A DICTIONARY of CHEMISTRY, and the Allied Branches of other Sciences. By HENRY WATTS, F.R.S., assisted by eminent Scientific and Practical Chemist

"The greatest work which England has yet produced on chemistry—one of the greatest, indeed, which she has produced upon any scientific subject—is finished at last, and we are able to congratulate Mr. Watts most sincerely upon its completion."—*Chemical News.*
"The English language is not rich in lexicons of science: we would point to this work as a model upon which others might be framed. It certainly exhausts the subject up to the date of publication, and therefore forms as it were the balanced ledger of the chemist."—*Athenæum*

London: LONGMANS and CO.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.
Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.
The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.
Especial facilities or persons preparing for Government and other examinations.
Private Pupils will find every convenience.
Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.
Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal P lytechnic Institution.

THE CEYLON TELEPHONE,
Price 45., Complete.

Corners being easily turned, the line can be carried through a house, and a Telephone may be knotted to the line in each apartment, so that several persons can hear while one speaks or sings at the distant instrument. Each box contains 4 Polished Wood Telephones, rings and staples, and 20 yards of line, prepared so that it will not be affected by changes in the atmosphere.
To be had of Opticians, Scientific Toy Warehouses, and 4, Champion Grove, Camberwell.

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the following terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays.. ..	£2	2 0
200 Specimens, in Cabinet, with 5 Trays.. ..	5	5 0
300 Specimens, in Cabinet, with 9 Drawers ..	10	10 0
400 Specimens, in Cabinet, with 13 Drawers ..	21	0 0

More extensive Collections at 50 to 5000 Guineas each.

THE CHEMICAL NEWS.

VOL. XXXVII. No. 957.

ON THE COMPOSITION OF THE VITRIOL RUNNING FROM ABSORBING AND DENITRATING TOWERS.

By GEORGE E. DAVIS.*

IN my former paper I pointed out that the estimation of the nitrous compounds in nitrosulphuric acid could not be effected in most instances by means of an oxidising agent, owing to the presence of other reducing substances than nitrogen oxides; but I also showed that the numbers obtained by permanganate from Gay-Lussac acid were nearly identical (when calculated as nitrous anhydride) with those obtained by reduction with mercury and subsequent measurement of the gas.

This, however, is not the case with the acids running from the denitrating column—the nitrogen oxides are nearly always totally abstracted, yet the permanganate often shows 2 grms. per litre, if the reduction of the standard oxidant is calculated to nitrous anhydride.

I have made many experiments upon this subject during the past few years; but the subject is fraught with more than ordinary difficulty, owing to the presence of arsenic and arsenious compounds, organic matter, ferrous sulphate, &c., and also to the fact that the nitrogen compounds themselves are not always all in the same state of oxidation.

The permanganate values corresponding to the mercury values led me to the conclusion that in Gay-Lussac acid the whole of the arsenic was present as arsenic acid, and the following experiments upon the same sample of acid put this beyond doubt.

It was at first thought possible to estimate the arsenic present as arsenic acid, by eliminating most of the sulphuric acid by barium hydrate, rendering alkaline and precipitating with magnesia mixture; but after many discordant results had been obtained it was found that the precipitated sulphate of baryta always contained arsenic.

It was next thought to neutralise with caustic potash removing the sparingly soluble sulphate; but although this was not open to the objection urged against the baryta, it was found that there existed in most vitriols, enough sulphate of alumina to carry down upon neutralisation a large quantity of the arsenic as arseniate of alumina.

Ten c.c. of the acid were rendered alkaline with ammonia and boiled; the precipitated arseniate of alumina was collected, dissolved in sulphuric acid, reduced with sulphur dioxide, and precipitated with hydrogen sulphide, the arsenious sulphide was oxidised with nitric acid (sp. gr. 1·50), precipitated with magnesia mixture, and weighed as magnesium pyro-arseniate. The results were as follows:—

Arsenic calculated as As_2O_5, grms. per litre.

1. 4·79	2. 4·66

In another series of experiments, sulphate of alumina was added and then excess of ammonia; the arseniate of alumina, when treated as above, gave the following results calculated as As_2O_5 in grms. per litre:—

1. 7·64	3. 7·55
2. 7·49	4. 7·48

In another series of experiments the vitriol was diluted with water, reduced with sulphur dioxide, and the arsenic thrown down as sulphide, which was oxidised and weighed as magnesium pyro-arseniate. Four expts. gave numbers as follows:—

1. 7·73	3. 7·60
2. 7·68	4. 7·72

Of course these experiments did not prove that the whole of the arsenic was present as arsenic acid; therefore Reicker's process was followed for the separation of arsenious and arsenic acids, viz., by distilling with sodium chloride. The distillate on being examined for arsenic contained traces only; the residue was then treated with sulphur dioxide, and the arsenic thrown down as sulphide, being weighed as before as pyro-arseniate.

The results were, in grms. of As_2O_5 per litre,—

1. 7·58	3. 7·61
2. 7·53	4. 7·72

Mean of four expts. for total arsenic .. 7·68
" " " arsenic in residue .. 7·61

This was considered very good proof that the whole of the arsenic was present as arsenic acid, the more especially as Mayerhofer has stated that when arsenic acid is heated with hydrochloric acid, arsenic is found in the distillate.

If then the whole of the arsenic was present as arsenic acid, and the nitrogen compounds were eliminated, the acid, when diluted with water, should become coloured upon adding a few drops of permanganate solution, unless some other reducing bodies were present.

With this end in view 10 c.c. of the vitriol were diluted with 20 c.c. water, and 2 grms. ammonium sulphate added—the whole boiled again to 10 c.c. This was then diluted with water, previously coloured with permanganate, of which latter 6·4 c.c were required to produce the same tint. This experiment was repeated several times with the same result.

The same experiment was then tried by simple dilution with water and boiling, when the following c.c. of decinormal permanganate were required in 4 expts.

1. 6·7 c.c.	3. 6·8 c.c.
2. 6·9 c.c.	4. 6·8 c.c.

The conclusion was, therefore, arrived at, that there exists in ordinary nitro-sulphuric acid substances other than nitrogen or arsenic compounds, which decolourise permanganate solution, probably ferrous sulphate and organic matter.

10 c.c. of the vitriol when largely diluted consumed 53·3 c.c. of decinormal permanganate.

2 c.c. when shaken with mercury yielded 12 c.c. of nitric oxide.

Lunge has stated in CHEMICAL NEWS vol. xxxvi. p. 147), "It was positively proved that by the more usual plan of testing nitrous vitriol, nitric acid is generated in the process of dilution, according to the equation:—

$$3NOOH = 2NO + NO_2OH + H_2O."$$

This may be the case when pure hydrogen nitrite is diluted with water (but of this I have no positive proof); but have we hydrogen nitrite in nitrous vitriol? I say no. It exists as nitrous anhydride, and the vitriol possessing such a strong affinity for water does not allow the formation of such a weak hydrogen salt as hydrogen nitrite. The nitrous anhydride, by reason of the strong vitriol in which it is dissolved, dissolves in water as such, and Frémy has also observed, that in a large excess of water, nitrous anhydride dissolves without decomposition (Comp. *Rendus.*, ixx., 61.)

I considered this proved by experiments made in 1872, and I have made more expts. lately, as follows:—

When 10 c.c. of nitrous vitriol is introduced into the bottom of a large flask, containing, say, 500 c.c. of water, and the acid and water gradually allowed to mix, no gas can be seen liberated, and if the experiment is carefully performed, the atmosphere of the flask does not alter iodide of starch paper. To the flask now add some

* A paper read before the Faraday Club.

potassium iodide solution, when, after a slight agitation to mix the two solutions, a gas is found to be liberated in quantity, and which is nitric oxide.

The hydriodic acid reduces the N_2O_3 to N_2O_2, a small quantity of which remains in solution, the major part, however, escaping as a gas.

The inference I draw from the observations of the above experiments, is—that as nitric oxide is but very sparingly soluble in water, if this had been formed upon simple dilution with water, some of it would have escaped as gas, whereas, nitric oxide does not escape until iodide of potassium is added.

Now, if we look back to the experiments already quoted, we shall find that there were required 53·3 c.c. of total permanganate, and 6·4 c.c. after the nitrogen oxides had all been decomposed, and as all the arsenic was present as arsenic acid, the quantity of oxidising material required for the oxides of nitrogen would be :—

53·3 minus—6·4=46·9 c.c.

Now, 46·9+0·0019, the factor for N_2O_3, gives 8·911 grms. per litre of nitrous anhydride; but calculating the N_2O_3 from the actual nitric oxide measured (*i.e.* from the 12 c.c. liberated from the 2 c.c. vitriol), it becomes evident that there is a nitrogen oxide present, the factor for which is greater than 0·0019.

Now, supposing the three nitrogen oxides here concerned, are completely converted by decinormal permanganate into nitric acid, their factors will be :—

Nitrogen peroxide (N_2O_4)	0·0046
„ trioxide (N_2O_3)	0·0019
„ dioxide (N_2O_2)	0·0015

Therefore it will be seen that from the numbers obtained by experiment, it is possible, that each of these three oxides may be present together; but as we know that nitric oxide is almost insoluble in strong oil of vitriol, the acid can only become saturated with it, the rest escapes. The error caused by the presence of nitric oxide is scarcely appreciable; there only remain then the two elements—the factors for the trioxide and tetroxide.

The 12 c.c. of nitric oxide liberated from from the 2 c.c. of vitriol correspond to 10·23 grms. per litre of nitrous anhydride.

From this we find, that of the 46·9 c.c. of decinormal permanganate reduced by nitrogen compounds; 40·43 c.c. were consumed by nitrous anhydride, and 6·47 c.c. by nitrogen tetroxide, making the amounts of the various substances in grms. per litre as follows:—

Arsenic acid (As_2O_5)	7·61
Nitrogen tetroxide (N_2O_4)	2·97
" trioxide (N_2O_3)	7·68

Turning now from the Gay-Lussac acid to that running from the denitrating column, the arsenic is found in its two states of oxidation. Determining the amounts by Reicker's process, I found :—

	I.	II.
As_2O_3	6·14	7·23
As_2O_5	2·38	2·94

These were two distinct samples.

Now, when the denitrated acid is shaken up with mercury, the dissolved sulphur dioxide is often liberated; therefore I find it better to add a minute quantity of finely powdered permanganate of potash to the acid before measuring off the quantity for examination, as by shaking with mercury it may be liberated in the gaseous form, and mistaken for nitric oxide.

The sulphurous acid may be estimated by heating the vitriol in a tube, filled with beads, aspirating a current of dry carbonic acid, passing the liberated gas into peroxide of hydrogen, and weighing as barium sulphate. In this manner I have found, in grms. per litre of SO_2 in various samples :—

1. 0·11	3. 0·09
2. 0·08	4. 0·12

After oxidising the sulphur dioxide with permanganate, the nitrogen dioxide present may be estimated by shaking up with mercury—I usually employ 10 c.c. of the O.V. The nitric oxide seems to be mechanically mixed rather than in true solution, and the agitation simply liberates it. Six different samples of acid running from the denitrating column gave N_2O_2 as under :—

1. 0·13	4. 0·03
2. 0·00	5. 0·06
3. 0·02	6. 0·00

A sample of sp. gr. 1·75 running from the denitrating column, gave as follows :—

As_2O_3	6·26 Grms. per litre.
As_2O_5	1·98 „
SO_2	0·12 „
N_2O_2	0·04 „

This was the acid which, when run down, the absorbing column gave the acid already examined. We may compare them as follows :—

	Before going down absorber Grms. per litre.	After Grms. per litre.
As_2O_3	6·26	0
As_2O_5	1·98	7·61
N_2O_4	0	2·97
N_2O_3	0	7·68
N_2O_2	0·04	—
SO_2	0·12	0

From the foregoing experiments, we learn that the arsenic becomes peroxidised by running down the absorbing column, and again becomes deoxidised by running down the denitrating column.

Barton Arcade, Manchester.
Jan. 16, 1878.

POSSIBLE USE FOR A CONSTITUENT OF GAS-LIME.

By THOMAS DOUGLAS.

The following experiment was made some months since to find if the sulpho-cyanates, usually found in some quantity in gas-lime, could be readily transformed into ferro-cyanides. It is an established reaction that potassium sulpho-cyanate and iron-filings heated together yield potassium ferro-cyanide and the sulphides of potassium and iron. I wished to determine if a crude sulpho-cyanate extracted from gas-lime would give a ferro-cyanide with the same treatment.

Some gas-lime was mixed with about 5 per cent of soda-ash, extracted with water, and the solution evaporated to dryness. The dry extract was mixed with iron-filings in a mortar, then heated in a small covered clay crucible for a short time over a Bunsen lamp. The residue, boiled with water and acidified with hydrochloric acid, gave an abundant precipitate of Prussian blue with ferric chloride.

I have not time, and it is rather out of my way, to experiment further on this subject at present. It was called to mind by the report of Mr. Mayer's paper on "Hislop's Process for the Regeneration of Gas-Lime," in a recent issue of the Chemical News (vol. xxxvii., p. 89). If the above process for obtaining ferro-cyanides from gas-lime should prove of any commercial value it would be a ready method of getting rid of at least part of the sulphur compounds in gas-lime. Alkaline sulpho-cyanates are very soluble in water, and a strong solution would be obtained by passing the same liquor through successive fresh portions of gas-lime until saturated.

Whickham-on-Tyne

ANALYSES OF CANE AND BEET-ROOT SUGAR ASH.

By J. W. MACDONALD.

The Chemical News, vol. xxxvii, p. 76, contains an analysis of Demerara sugar ash, by Dr. Wallace, which is very interesting. Perhaps the following may also be of interest, especially to those of your readers connected with Messrs. Duncan and Newland's alum process.

The samples were obtained by preserving the ashes of *all* cane and beet sugars, analysed in the laboratory of a large sugar refinery, during one year. The analyses may therefore be taken as representing the average composition as regards bases, phosphoric and carbonic anhydrides and chlorine having been displaced by the sulphuric acid employed in the sugar analyses.

It will be noticed that cane ash contains a larger proportion of lime, magnesia, ferric oxide, and sand than beet. These substances are removed from the juices in the beet manufactories, but in the West Indies and cane-producing countries the manufacture of sugar has not yet reached such a perfect state.

	Cane Ash.	Beet Ash.
Potash	28·79	34·19
Soda	0·87	11·12
Lime	8·83	3·60
Magnesia	2·73	0·16
Ferric oxide and alumina ..	6·90	0·28
Sulphuric anhydride	43·65	48·85
Sand and silica	8·29	1·78
	100·06	99·98

Love Lane Refinery, Liverpool.

ON THE

SULPHATES OF THE VANADIUM PENTOXIDE.

By Dr. B. W. GERLAND.

Berzelius has described two compounds of vanad-pentoxide with sulphur trioxide, $V_2O_5,3SO_3$ and $V_2O_5,2SO_3$, and mentioned in addition to these a mono-basic and a mono-acid sulphate, of which no composition is given.

Vanad-pentoxide is more or less soluble in sulphuric acid according to its preparation. The crystals formed by cooling the molten pentoxide require a long-continued digestion at an elevated temperature, whilst the crystalline powder obtained by roasting the ammonium vanadate dissolves readily. This salt is decomposed slowly but completely in a current of air at a temperature of 140° C., yielding a dark brown pentoxide, which, when mixed with sulphuric acid and a little water, enters into solution with evolution of heat. The higher the temperature to which the pentoxide is subjected the lighter are its colours, until towards 200° a light brick-red powder is obtained, and the more it resists the solvent action of sulphuric acid. The microscopic scales of the meta-vanadic acid, notwithstanding their thinness, require long digestion with sulphuric acid at an elevated temperature. The concentrated solutions, whether prepared hot or cold, are deep reddish brown, and solidify on cooling to a crystalline mass of the colour and appearance of ferric chloride: addition of water changes the colour successively to blood-red (like ferric acetate) olive-green, and pale yellow. These solutions are easily acted upon by reducing substances, and all the more so the higher their temperature and the more they are concentrated.

The Dialysis of the Solution of Vanad-pentoxide in Sulphuric Acid.—A solution of the pentoxide in an excess of sulphuric acid, which has been boiled or kept for some time, readily parts with the excess of the acid, leaving the compound $V_2O_5,3SO_3$. This compound, by continued exposure, loses sulphuric acid very slowly, and the composition approaches more and more that expressed by the formula $V_2O_5,2SO_3$.

(1.) A solution containing 1 grm. V_2O_5, and an excess of sulphuric acid measuring 10 c.c., was brought upon the dialyser with parchment-paper, and floated upon an equal volume of water: the latter was renewed five times in three days, when the remaining liquor was analysed :—

Found —
$PbSO_4$ .. 0·2503 grm. V_2O_5 .. 0·0502 grm.
Calculated—
SO_3 .. 0·0661 grm. V_2O_5 .. 0·0502 grm.

SO_3 and V_2O_5 are therefore in the proportion, 3 mols. SO_3 to 1 mol. V_2O_5.

(2.) A solution of the sulphate, prepared like the former, was placed in the dialyser, and floated on a larger volume of water, about ten-fold the quantity, which was changed seven times in ten days. The colour of the sulphate had passed from green to yellow, but no deposit was formed. The composition was found to be—

$PbSO_4$ .. 0·3775 grm. V_2O_5 .. 0·0993 grm.
Calculated—
SO_3 .. 0·0996 grm. V_2O_5 .. 0·0993 grm.

That is, $SO_3 : V_2O_5 = 2·29$ mol. : 1 mol.

In another experiment made under similar circumstances :—

(3.) The solution left in the dialyser yielded by analysis—

$PbSO_4$ .. 0·2109 grm. V_2O_5 .. 0·0537 grm.
Calculated—
SO_3 .. 0·0577 grm. V_2O_5 .. 0·0537 grm.

Or 2·36 mol. SO_3 to 1 mol. V_2O_5.

A solution recently prepared of the brown pentoxide, obtained by roasting ammonium vanadate at a low temperature, in cold dilute sulphuric acid behaves essentially differently on the dialyser. 20 grms. pentoxide dissolved in 45 grms. sulphuric acid, diluted to 300 c.c., were brought upon the dialyser, and placed on 400 c.c. water. The solution soon became blood-red, like ferric acetate; and on the third day, after two changes of the outer water, large deposit of brown vanadic acid had formed upon the membrane, and a smaller one in the outer water. The deep red colour of the solution changes to green on the addition of sulphuric acid.

10 grms. of the clear red solution from the dialyser yielded—

$PbSO_4$ .. 0·7642 grm. V_2O_5 .. 0·2532 grm.
Calculated—
SO_3 .. 0·2017 grm. V_2O_5 .. 0·2532 grm.

Or 1·81 mol. SO_3 to 1 mol. V_2O_5.

The filtered liquor, left to itself, continues to deposit vanadic acid, and thereby changes its colour from deep red to yellow and green. After five days' standing it was submitted to analysis.

20 c.c. yielded—

$PbSO_4$ .. 1·5297 grm. V_2O_5 .. 0·2610 grm.
Calculated—
SO_3 .. 0·4039 grm. V_2O_5 .. 0·2610 grm.

Or 3·53 mol. SO_3 to 1 mol. V_2O_5.

20 c.c. of the same solution, taken seven days later, yielded—

$PbSO_4$ .. 1·5157 grm. V_2O_5 .. 0·2687 grm.
Calculated—
SO_3 .. 0·4008 grm. V_2O_5 .. 0·2687 grm.

Or 3·43 mol. SO_3 to 1 mol. V_2O_5.

It therefore appears that during the last seven days a portion of the vanadic acid was re-dissolved.

Another solution, prepared by dissolving the brown pentoxide in cold sulphuric acid, was subjected to dialysis in the apparatus, and upon the same membrane used in the above-described experiment, which yielded the compound $V_2O_5,3SO_3$ from boiled solution of pentoxide in an excess of sulphuric acid after five renewals of the water. The solution underwent the same changes as in the last

trial; it was analysed when the colour was deep red, and a deposit of vanadic acid formed. Found—

$PbSO_4$.. 0·1074 grm. V_2O_5.. 0·0487 grm.

Calculated—

SO_3 .. 0·02835 grm. V_2O_5.. 0·0487 grm.

Or 1·32 mol. SO_3 to 1 mol. V_2O_5.

These results leave no doubt that a difference exists in the constitution of the solutions of vanad-pentoxide in sulphuric acid prepared in the cold, and the same solution after heating (and probably after the lapse of time): the former contains a molecular compound, which is converted by boiling into the atomistic compound, $V_2O_23SO_4$, *Vanadylic Sulphate*. Nevertheless, both solutions possess the same colour, and this undergoes the same changes by dilution with water. It would be interesting to examine into the thermic relations of these compounds, only want of convenience prevented me from investigating this remarkable behaviour in that direction.

Vanadylic Sulphate, $V_2O_23SO_4$.—This compound is obtained (according to Berzelius) by evaporating the solution of vanad-pentoxide in an excess of diluted sulphuric acid and expelling the latter at a low temperature. The concentrated solution was exposed in an air-bath to a temperature of 200°. Clouds of sulphuric acid escaped, and when these decreased the heating was interrupted. A hard crystalline red substance was left: this absorbed moisture rapidly, and formed a dark brown solution, but on the addition of water it was at once decomposed with the separation of vanadic acid. The solid residue was superficially tinged green by the insoluble vanadylous sulphate, $V_2O_22SO_4$, owing to the fire-gases having found access, but otherwise it was of a bright brick-red colour and crystalline texture. For analysis the weighed sample was treated with highly dilute nitric acid in the cold, whereby the vanadylic sulphate is dissolved without separation of vanadic acid, and the vanadylous sulphate is left intact.

(1.) Sample from the interior. Found, per cent—

$V_2O_2,2SO_4$.. 1·38 $PbSO_4$.. 188·58 V_2O_5.. 47·49

(2.) Sample from the exterior. Found, per cent—

$V_2O_2,2SO_4$.. 15·19 $PbSO_4$.. 161·60 V_2O_5.. 43·35

Calculated—

	I.	II.
$V_2O_2,2SO_4$ ..	1·38	15·19
V_2O_5	47·49—1 mol.	43·35—1 mol.
SO_3	49·46—2·38 mol.	42·66—2·25 mol.
	98·33	101·20

The neutral sulphate, $V_2O_23SO_4$, therefore suffers a gradual decomposition by the temperature of 200°; the substance left in the experiment is a mixture of neutral sulphate and basic sulphate, $V_2O_2,O,2SO_4$.

A concentrated solution of vanad-pentoxide in a large excess of sulphuric acid, when rapidly boiled, deposits small crystals, which are sometimes of an opaque brown, and sometimes of a splendid ruby colour, transparent, of great lustre, and apparently regular octahedrons. If the boiling is interrupted soon after the first appearance of these crystals, fine needle-shaped crystals of golden colour separate on cooling. All these different forms seem to have the same composition. The experiment requires the utmost attention, as the boiling becomes very violent as soon as the compound separates, and is managed only with difficulty owing to the high temperature and the mass of escaping sulphuric acid. The sulphate is easily deoxidised at that temperature by dust, and even by the fire-gases, and their exclusion is a matter with which I have only been successful in very few cases. Addition of perchloric acid counteracts these reducing agents to some extent; the same is decomposed by acid solutions of the tetroxide. The crystals while still hot were thrown on a Bunsen filter, and as quickly as possible placed between well dried porous tiles, and left under a bell dipping in vitriol. These crystals absorb moisture with avidity; with cold water or alcohol they form clear solutions, which, when heated, deposit brown vanadic acid, retaining some sulphuric acid. The analyses of different preparations gave the following results:—

			Insoluble $V_2O_2,2SO_4$. Grm.	$PbSO_4$. Grm.	V_2O_5. Grm.
(1.)	0·9867 grm. substance	yielded	—	2·0677	0·3412
(2.)	1·0433 ,,	,,	0·0570	2·1344	0·3880
(3.)	0·8529 ,,	,,	0·0776	1·6422	0·2950
(4.)	1·0979 ,,	,,	0·0863	2·1602	0·4140
(5.)	0·7967 ,,	,,	—	1·7554	0·2709
	0·6790 ,,	H_2O, 0·0597			
(6.)	0·6679 ,,	yielded	0·0775	1·1890	0·2716
(7.)	0·7657 ,,	,,	—	1·5633	0·2970
(8.)	0·6248 ,,	,,	—	1·2653	0·2680

Calculated for—

	(1.) p.c.	(2.) p.c.	(3.) p.c.	(4.) p.c.	(5.) p.c.	(6.) p.c.	(7.) p.c.	(8.) p.c.
$V_2O_2,2SO_4$ ..	—	5·46	9·10	7·86	—	11·60	—	—
V_2O_5	34·58	37·19	34·58	37·71	34·00	40·66	38·79	42·89
SO_3	52·69	54·01	50·83	51·95	56·17	47·00	53·90	53·47
H_2O					8·77			
					100·49			

It was not to be expected that the analyses of a subtance so hygroscopic as this, and so difficult to prepare and purify, should give satisfactory results; still if the above figures do not absolutely prove, they at least make it most probable, that the pure compound is anhydrous, and is to be expressed by the formula $V_2O_23SO_4$. With this formula the analyses (2.), (4.), (6.), (7.), agree best. For the sake of comparison they are re-calculated after deduction of the accidental vanadylous sulphate, and placed beside the composition corresponding to the formula $V_2O_23SO_4$.

	Found. (2.)	(4.)	(6.)	(7.)	Calculated for $V_2O_23SO_4$.
V_2O_5	39·4	40·9	46·0	38·8	43·2
SO_3	57·1	56·4	53·2	53·9	56·8
H_2O (difference)	3·5	2·7	0·8	7·3	—
	100·0	100·0	100·0	100·0	100·0

The acid solution, from which these crystals have separated, is of a light brown colour, and retains only a small amount of vanad-pentoxide, as the following analysis demonstrated:—

1·584 grm. of the acid solution separated from the crystals yielded—

$PbSO_4$.. 4·7976 grms. V_2O_5.. 0·0330 grm.

Calculated—

V_2O_5	2·08
SO_3..	79·89
H_2O (difference)	18·03
	100·00

(To be continued.)

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, March 22, 1878.

Dr. J. H. Gladstone, F.R.S., President, in the Chair

After the announcement of visitors, &c., the following certificates were read for the first time:—G. A. George, W. Jago, H. W. Jones, and J. W. Knights.

The President then announced that Mr. E. Neison having proposed Mr. C. T. Kingzett as a member of the Council, the name of the latter gentleman would be suspended along with the list of names recommended by the Council.

The first paper was read by Dr. OTTO N. WITT, "*On Aromatic Nitrosamines.*" In 1874 the author made some experiments on the action of nitrous acid, and especially its ethers, on secondary and tertiary amines: the facts observed were communicated to the Chemical Societies of Zurich and Berlin. In his inaugural dissertation (1875) the author gave a detailed account of the formation and properties of diphenyl-nitrosamine. Since that time a more careful study of some complicated reactions of diphenyl-nitrosamine has been made, and the results of these investigations the author gives in the following paper:—Whenever a secondary amine is acted upon by nitrous acid water is given off, and a nitrosamine (*i.e.*, a substituted ammonia which contains instead of at least one hydrogen, the mono-valent group NO in immediate connection with the ammoniacal nitrogen) is formed. Thus—

$$\begin{matrix} C_2H_5 \\ | \\ NH \\ | \\ C_2H_5 \end{matrix} + HONO = H_2O + \left\{ \begin{matrix} C_2H_5 \\ | \\ N—NO. \\ | \\ C_2H_5 \end{matrix} \right.$$

Diethyl-amine. Diethyl-nitrosamine.

Similarly, by the action of ethylic nitrite, amylic nitrite, or nitrous vapours on diphenylamine, diphenyl-nitrosamine is formed. This latter substance crystallises readily in large, honey-coloured, monoclinic crystals, melting at 66·5° C., soluble in alcohol, benzol, &c. It dissolves readily in concentrated sulphuric acid with a beautiful blue colour, large quantities of nitric oxide being evolved. Powerful reducing agents split off ammonia, and reproduce diphenylamine. The action of aniline and the primary monamines on diphenyl-nitrosamine is violent, diphenylamine being regenerated, with the formation of diazobenzol, the latter forming successively diazo-amidobenzol and amido-azobenzol. Under certain circumstances a secondary reaction takes place, a substance, $C_{36}H_{29}N_5$, being formed, which, when treated with sulphuric acid, gives a blue colouring matter with a crimson fluorescence and a spectrum of three dark bands. If ordinary ethylic nitrite—obtained by passing nitrous vapours into alcohol—be used, a mixture of products is formed, in the investigation of which the author encountered many difficulties. When burnt in a combustion-tube these bodies gave off rapidly large quantities of nitrous vapours, whilst a very dense charcoal was left behind, which was difficult to burn completely. On investigation the author found that the substance commonly called anhydric nitrous acid (prepared by the action of nitric acid on starch, &c.) is really N_2O_4, and splits up by contact with alcohol or water into nitric and nitrous acids. Thus ordinary ethylic nitrite always contains nitric acid. The author therefore used mixtures of pure amylic nitrite and nitric acid; acting with these on known weights of diphenylamine, and moderating or accelerating the reactions by the use of various solvents, he has obtained mono-nitro-diphenyl-nitrosamine and two bodies which, on the removal of their nitroso-groups, yielded dinitrodiphenylamine, and an isomer. Mono-nitro-diphenyl-nitrosamine.—To 20 grms. of diphenylamine, finely powdered, a mixture of 15 c.c. nitric acid, 35 grms. pure amyiic nitrite, and 100 c.c. of methylated alcohol is added. On shaking—and, if necessary, heating—crystals separate. The liquid is now cooled by ice, when a crystalline deposit is obtained, which is filtered off, washed with spirit, dried, and re-crystallised from chloroform. This substance forms light yellow plates, melting at 133·5° C., soluble in benzol, hot alcohol, and glacial acetic acid. When treated with strong sulphuric acid it gives off nitric oxide, the liquid becoming purple. By the action of aniline or alcoholic potash mono-nitro-diphenylamine was obtained in pale yellow glistening scales, melting at 132° C. It does not colour sulphuric acid, but dissolves in alcoholic potash with a fine red colour. By the action of bromine on mono-nitro-diphenyl-nitrosamine dissolved in glacial acetic acid two products were obtained—one in canary-yellow coloured silky needles fusing at 208·5° to 209°; the second in heavy, well-shaped, small prisms, melting at 214·5° to 215°. If instead of the quantities given above the following be used—17 grms. diphenylamine, 50 c.c. glacial acetic acid, 40 c.c. nitric acid, 50 c.c. methylated spirit, and 48 grms. nitrite of amyl—a light yellow sandy powder is obtained, which dissolves in sulphuric acid with a dirty violet colour, nitric oxide being given off. The analyses seemed to indicate a formula intermediate between di- and trinitro-diphenyl-nitrosamine. The author therefore acted on the substance with aniline, and alcoholic potash, precipitating the resulting liquid with dilute hydrochloric acid. By treating this precipitate with alcohol a solution was obtained, which furnished long, thick pointed, dark yellow needles, fusing at 214°, and dissolving in alcoholic potash with a bright purple colour. Analysis proved this substance to be dinitrodiphenylamine. The residue insoluble in alcohol was recrystallised from xylene, and obtained in granular vermilion crystals fusing at 211·5°, which dissolve in alcoholic potash with a scarlet colour. Analysis proved this substance to be isomeric with the last. All the above substances, when treated with strong nitric acid, yield hexa-nitro-diphenylamine. The author points out that the method of nitration above described will probably be found applicable in many cases where nitration has hitherto offered unusual difficulties, and also lends some support to the theory that the formation of nitroso-compounds always precedes the introduction of the nitro-group into the molecule of aromatic substances. The author mentions in conclusion that Mr. Meldola communicated to the CHEMICAL NEWS (Feb. 8, 1878) a note on a new colouring matter. On examination this new dye-stuff, "Citronin," turned out to be a mixture of mono- and dinitro-diphenylamines. Mr. Meldola, on learning that the author had been engaged with these bodies for some years, relinquished the investigation. For this act of courtesy the author thanks Mr. Meldola, but wishes to state that the merit of the practical application of this substance as a dyestuff belongs solely and entirely to that chemist. The author promised a second paper in continuation of the research, and stated that but for the incident just referred to he should not have published his researches at so early a date.

Mr. MELDOLA said that Dr. Witt had given a perfectly correct statement of the case as far as he was concerned. At the time he first obtained citronin he was aware that Dr. Witt had been working at the subject, and therefore thought that he was the proper person to communicate with. His communication, he ventured to think, considering the interesting paper they had just heard, had been attended with the happiest results as regards the Society and himself.

Mr. GROVES remarked that when phenol is acted upon by dilute nitric acid a small quantity of nitroso compounds seems to be first formed; also in the formation of trinitro-orcin, nitroso compounds seemed to be at first produced, thus confirming the statement of Dr. Witt.

Dr. ARMSTRONG thought that although in many cases we had evidence of the pre-formation of nitroso compounds, yet it probably was not always the case. Thus some of the sulpho-acids of phenol nitrate with very great readiness without any indication of nitroso compounds being formed.

After a short discussion between Drs. Armstrong and Witt as to the constitution of the bodies mentioned in the above paper,

The PRESIDENT gave the best thanks of the Society to Dr. Witt for his interesting paper, which was illustrated by experiments and the exhibition of specimens of the above beautifully crystallised substances.

The next paper was read by Dr. ARMSTRONG, and was entitled "*On a New Process for the Volumetric Estimation of Cyanides*, by J. B. HANNAY. The cyanide is dissolved in water, and the solution is rendered alkaline by ammonia. A half-strength decinormal solution of mercuric

chloride is run in with constant stirring. At first the reaction $2KCN+HgCl_2=Hg(CN)_2+2KCl$ takes place, but as soon as all the cyanide has been thus decomposed the slightest trace of mercuric chloride renders the liquid distinctly opalescent. The end reaction is sharply marked and very delicate. Many experiments were performed as to the action of alkaline sulphates, chlorides, and nitrates. The results were similar to those already obtained by Tuson and Neison (*Chem. Soc. Journ.*, 1877, ii., 679). Very large quantities of ammonium salts prevent the appearance of the opalescence. Cyanates and sulphocyanides do not interfere. The presence of silver salts does not hinder the reaction. The author, therefore, recommends the process as one of great facility.

The next paper was read by Mr. M. M. P. MUIR, "*On Certain Bismuth Compounds* (*Part* VII.)." In the first portion of this paper the author details reactions illustrating some points of contrast between bismuthous and phosphorous chlorides. The latter substance is oxidised with comparative ease, and therefore acts as a reducing agent in certain reactions: the former undergoes only incomplete oxidation, and therefore exerts no action in such cases. The two oxalates of bismuth, $Bi_23C_2O_4.6H_2O$, and $Bi_2C_4O_8$, are then studied. Experiments on the production of some so-called bismuthates are next detailed. The author inclines to the hypothesis that the higher oxides of bismuth exhibit exceedingly feeble acid characters. The paper concludes with the description of some experiments on bismuthous iodide. The oxidation of this compound by air when in a fused state is compared with the behaviour of the corresponding chloride and bromide under similar conditions: the iodide oxidises much more slowly than either the chloride or bromide. Bismuthous iodide prepared in the wet way is more readily decomposed by water than the same salt prepared in the dry way.

The thanks of the Society were given to the author, who exhibited an interesting series of bismuth compounds.

Mr. WILLIAMS then exhibited a splendid sample of salicylic acid, about 24 ounces, prepared from the oil of winter-green, the natural product crystallising apparently better than the artificially prepared acid; also about 1 gallon of pure methylic alcohol.

Dr. WITT, in answer to Mr. Maxwell Lyte, said that the "vinasses," formerly a waste-product of the beet-root sugar manufacture, had lately been utilised under a patent for the production of methylic chloride, which was largely used by the aniline colour manufacturers. The gas was prepared, washed, and pumped into metal reservoirs, containing 25 kilogrms. each; the patentee, Brigonnet, making as much as 1000 kilos. a day.

The Society then adjourned to April 4 (Anniversary Meeting, Saturday, March 30), when a lecture "On the Application of the Microscope to some Special Branches of Chemistry," will be delivered by H. C. Sorby, F.R.S.

EDINBURGH UNIVERSITY CHEMICAL SOCIETY.

Seventh Meeting, March 13, 1878.

W. INGLIS CLARK, B.Sc., in the Chair.

A PAPER was read by Mr. ADRIAN BLAIKIE on the "*Salts of Trimethyl-sulphine*," containing the results of an investigation carried on by Professor CRUM BROWN and the author.

The hydrate of trimethyl-sulphine obtained by acting on the iodide of trimethyl-sulphine with moist oxide of silver in concentrated solution rapidly absorbs sulphuretted hydrogen, forming a sulphydrate of trimethyl-sulphine—

$$(CH_3)_3S.OH+H_2S=(CH_3)_3S.SH+H_2O.$$

The strong solution of this hydrate has all the reactions of an alkaline sulphydrate, and when evaporated oxidises slowly to the hyposulphite of trimethyl-sulphine.

The sulphide of trimethyl-sulphine is obtained by mixing equal quantities of solutions of oxyhydrate and sulphydrate of trimethyl-sulphine,

$$(CH_3)_3S.OH+(CH_3)_3S.SH=[(CH_3)_3S]_2S+H_2O.$$

The aqueous solution, when evaporated over phosphoric anhydride in an atmosphere of coal-gas, does not crystallise out, but after a certain strength of solution has been reached begins to decompose into sulphide of methyl,

$$[(CH_3)_3S]_2S=3(CH_3)_2S,$$

which, when the solution is contained in a sealed tube, separates out, forming a layer of sulphide of methyl above the aqueous solution. This solution has, however, all the characteristics of an alkaline sulphide. It dissolves sulphide of antimony, gives the reaction with sodic-nitroprusside, and with hydrochloric acid gives off sulphuretted hydrogen, leaving the chloride of trimethyl-sulphine, easily recognised by mercuric chloride, when the double salt crystallises out. When exposed to the air the sulphide of trimethyl-sulphine is rapidly oxidised to the hyposulphite.

The hyposulphite of trimethyl-sulphine is best obtained by oxidation of the polysulphide obtained by dissolving sulphur in the sulphide.

$$[(CH_3)_3S]_2S+4S=[(CH_3)_3S]_2S_5.$$

By exposing the polysulphide to the air for a few days the sulphur crystallises out, and the hyposulphite is left in solution, and by careful evaporation is obtained in clear four-sided prisms, with one molecule of water of crystallisation.

$$[(CH_3)_3S]_2S_5+3O=[(CH_3)_3S]_2S_2O_3+3S.$$

The following are results of analysis:—

I. 0·1192 grm. substance gave—
0·0745 grm. H_2O = 0·1086 grm. CO_2.

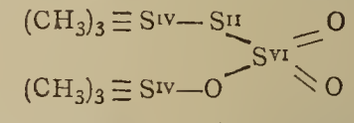
II. 0·2299 grm. substance gave—
0·1402 grm. H_2O = 0·2056 grm. CO_2.

III. 0·2600 grm. substance gave—
0·8459 grm. $BaSO_4$ = 0·1169 grm. S.

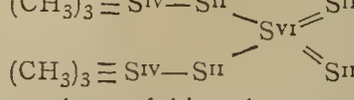
	Found.			Calculated for
	I.	II.	III.	$[(CH_3)_3S]_2S_2O_3+H_2O$.
C ..	24·85	24·64	—	25·35
H ..	6·94	7·06	—	7·04
S ..	—	—	44·65	45·07

The salt is very hydroscopic, sparingly soluble in alcohol, and gives all the reactions of an alkaline hyposulphite. Over phosphoric anhydride the water of crystallisation is given off. 7·261 grms. of the salt lost 6·37 per cent water, which is present in the crystallised salt to the extent of 6·33 per cent.

This compound is interesting from a theoretical point of view, since the constitutional formula may be represented with dyad, tetrad, and hexad sulphur atoms in one molecule.



For the same reason, on the assumption that the polysulphide is a sulphate in which all the oxygen atoms are replaced by sulphur, and also because in it, on this assumption, we may have *seven* atoms of sulphur directly grouped together, is the polysulphide of trimethyl-sulphine, from which the hyposulphite is obtained.



The anhydrous hyposulphite when carefully heated to 135° C. gives off sulphide of methyl. 5·545 grms. gave off when heated 23·58 per cent sulphide of methyl, leaving on cooling a white crystalline mass, soluble in water, alcohol, and ether, and very hydroscopic. The quantity of sulphide of methyl given off points to a methyl-hyposulphite of trimethyl-sulphine, since, if the hyposulphite

gave off 23·30 per cent sulphide of methyl, we should expect a substance having that composition.

$$[(CH_3)_3S]_2S_2O_3—S(CH_3)_2=(CH_3)_3S\diagup\!\!\diagdown^{CH_3}S_2O_3.$$

This product of decomposition is at present under investigation; by further heating at 140° sulphurous acid gas is evolved.

The oxalate of trimethyl-sulphine is obtained by acting on the iodide with oxalate of silver, and can be obtained in clear hydroscopic plates with one molecule water of crystallisation. The following are the results of analysis:—

I. 0·1526 grm. substance gave—
0·1082 grm. H_2O = 0·2068 grm. CO_2.
I. 0·1823 grm. substance gave—
0·1296 grm. H_2O = 0·2489 grm. CO_2.

	Found. I.	II.	Calculated for $\begin{matrix}COO—S(CH_3)_2\\ \vert \\ COO—S(CH_3)_3\end{matrix}+H_2O$.
C ..	36·95	36·78	36·92
H ..	7·87	7·89	7·69

On carefully heating the salt at 110° C. the water of crystallisation is given off, and at 140° C. sulphide of methyl, leaving pure oxalate of methyl, which crystallised out, and was recognised by its melting-point, 51° C., and its boiling-point, 157° C.

$$[(CH_3)_3S]_2(OOC)_2+H_2O=$$
$$=(CH_3)_2(OOC)_2+2S(CH_3)_2+H_2O.$$

The chromate and iodate of trimethyl-sulphine can both be prepared by means of the silver salts from the iodide. Both these salts, on heating to about 140° C., melt, but immediately afterwards explode, the former leaving green oxide of chromium.

The further decomposition of the hyposulphite of trimethyl-sulphine and of various other salts is under investigation.

A paper was also read by Mr. John Treharne, M.B., C.M., "*On the Cooling of Fats.*" If equal bulks of the fats of mutton, beef, pork, and butter, and palm oil be heated to 100° C. in a small flask fitted with a thermometer through the cork, and are then allowed to cool by radiation under the same conditions for each, the temperature is found to fall regularly to a certain point (which is different for each of the fats above named), and then to rise to a certain turning-point. These turning-points are approximately as follows:—

For mutton fat	40·0° C.
„ beef „	28·5 „
„ pork „	26·5 „
„ butter „	23·5 „
„ palm oil	21·0 „

The extent of the rise in temperature is different in each fat; being greatest in that of mutton, and least in that of butter and palm oil. The extent of the rise is also greater within certain limits the greater the quantity of fat employed; but, as a rule, the turning-point is pretty constant for the same fat. There is also a little difference in the turning-point and the extent of rise according to the part of the carcase from which the fat has been taken.

If temperature and time be taken as co-ordinates and the rate of cooling be represented by curves these latter will be characteristic of the respective fats. A mixture of equal parts of mutton and butter fats does not give a curve intermediate between those of its components, but is such as to indicate that less heat is given out in cooling (to 20° C. say) than in the case of butter, which, compared with mutton fat gives off very little heat.

Preparation of Methyl Allyl.—H. Grosheintz.—The author heats to 135° in an autoclave, a mixture of 40 parts zinc-methyl, 120 iodide of allyl, and 100 of an alloy of zinc and sodium at 3 per cent.—*Bulletin de la Societe Chimique de Paris.*

CORRESPONDENCE.

CHEMISTS AND CHEMISTS.

To the Editor of the Chemical News.

Sir,—I have asserted that of the two classes of chemists who now gain their living as chemists, the "Chemist and Druggist" is just able to say that he reckons his age by hundreds of years, while his namesake, better chemist though he be, only reckons his by tens; for, while some of the substances we term chemicals have been known for centuries, the age of chemistry as a science can still be written with two figures. "A Credulous Chemist" asks me for dates and references to satisfy doubters of the distinctive priority of "the druggist's" claim. I do not generally reply to anonymous correspondents, but as in response to my request he has given me abundant evidence that his credulity and his friendship are of as satisfactory a nature as I could possibly desire, I most gladly comply with his suggestions.

1493 to 1541.—Paracelsus, says Rodwell in his "Birth of Chemistry," helped to withdraw men from the pursuit of alchemy by asserting that the knowledge of the composition of bodies, which had necessarily been forwarded by alchemy, was of importance to the human race for the better prevention and curing of their ills. Butler, in his "Historical Introduction to Chemistry," in the ninth edition of the "Encylopædia Britannica," remarks that it was in the 16th century that a new race of alchemists, or spagyrists, as they were termed, arose, who, abandoning the search for the philosopher's stone, began to direct their energies to the discovery of chemical remedies for the various diseases of the body; and quotes the following words of Paracelsus:—"The true use of chemistry is not to make gold but to prepare medicines."

1653.—That alchemy did thus develop into what we should now term pharmaceutical chemistry is clear from the character of the first great text-book of chemistry published, which I shall notice in due chronological order; but even within little more than a century from the death of Paracelsus, it was possible to divide Materia Medica into "Chymical Medecins" and Galenicals (see Culpepper's "Translation of the Pharmacopœia," 1653; there is a copy in the library of the Pharmaceutical Society). Jacob Bell, in "A Concise Historical Sketch of the Progress of Pharmacy in Great Britain," after alluding to these chemical medicines, which were of mineral origin and prepared by fire, and the galenicals, which comprised the herbs, roots, and other vegetable or animal substances, goes on to state that: "The trade in these articles was also distinct, and chymists are alluded to in works of the date now under consideration [1653] as being a class of men who prepared these mineral compounds for the use of the apothecaries." Very much of my knowledge of the history of the "Chemist and Druggist" is derived from this little book by Bell. It contains 108 pages, and was published by Churchill in 1843. Copies are rare. I have one myself and there is one in the library of the Pharmaceutical Society at Bloomsbury Square. Its quotations and references, many of which I have verified, cover the period between 1511 and 1843. I will select a few bearing on this subject of chemists and chemists.

1671.—The author of the pamphlet, of this date, entitled "The Wisdom of the Nation is Foolishness," tells of a Dr. Merret who had recently given an account of certain apothecaries (that is compounders of goods supplied by the druggist, on the one hand, and the chemist on the other; for the "Chemist *and* Druggist" had not apparently yet come into existence). "Chymists which sell preparations honestly made complain that few apothecaries will go to the price of them. . . . . All the drugs imported into England sooner or later are made into medicines, although they have lain by years with the

merchant, druggist, and apothecary before they are used."

1680.—In some rhymes of this date a sort of apothecary-chemist is thus alluded to:—

"'Mongst all professions in the town
Held most in renown
From th' sword to the gown,
The upstart chymist rules the roast
For he with his pill
Does ev'n what he will,
Employing his skill
Good subjects to kill,
That he of his dangerous art may boast.

O 'tis the chymist, that man of the fire,
Who, by his black art,
Does soul and body part
He smokes us and choaks us
And leaves us like Dun in the mire."

1680.—In this year the Hon. Robert Boyle's assistant, Godfrey, or, rather, Ambrose Godfrey Hanckwitz, started a business in Southampton Street, Covent Garden, which has only quite recently been removed farther west by the present successor of "Godfrey and Cooke." Here is his original advertisement, interesting alike to chemists and chemists:—

"Ambrose Godfrey Hanckwitz, Chemist in London, Southampton Street, Covent Garden, continues faithfully to prepare all sorts of remedies, chemical and galenic. He hopes that his friends will continue their favours. Good cordials can be procured at his establishment, as well as Royal English drops, and other articles, such as Powders of Kent, Zell, and Contrajerva, Cordial red powder, Gaskoins powder, with and without bezoar, English smelling salts, true Glauber's salt, Epsom salt, and volatile salt of ammonia, stronger than the former. Human skull and hartshorn, essence of Ambergris, volatile essence of lavender, musk and citron, essence of viper, essence for the hair, vulnerary balsam, commendeur, balsam for apoplexy, red spirit of purgative cochliaria, spirit of white cochliaria, and others. Honey water, lavender water of two kinds, Queen of Hungary water, orange-flower water, and arquebusade.

"For the information of the curious, he is the only one in London who makes inflammable phosphorus, which can be preserved in water. Phosphorus of Bolognian stone, flowers of phosphorus, black phosphorus, and that made with acid oil, and other varieties. All unadulterated. Every description of good drugs he sells, wholesale and retail.

"Solid phosphorus, wholesale, 50s. an ounce, and retail £3, sterling, the ounce."

A copy of a portrait of Godfrey, engraved by George Vertue (1718), is in the possession of Messrs. Godfrey and Cooke. Copies of this picture he distributed among his customers, Bell says, as a keepsake. "Hâc Amicitiæ tesserâ Fautoribus valedicit Peregrinaturus Ambrose Godfrey Hanckwitz, Chymicus ad Phœnicem, Londini." This "Chemist at the sign of the Phœnix, London," safely received a letter from Berlin, Ince says, on January 31, 1719, bearing the simple inscription, "For Mr. Godfrey, famous Chymist in London." (See an excellent article on Godfrey by Joseph Ince in the *Pharmaceutical Journal*, 1858-59, pages 126, 157, and 215.

1686. Here is another advertisement. "Gaza Chymica. A magazine or storehouse of choice chymical medicines, faithfully prepared in my laboratory, at the sign of Hermes Trismegistus, in Watlin Street, London—by me, George Wilson, Philo.-Chym."

1691, "Pharmacopœia Bateana;" 1703, "The Craft and Frauds of Physicians exposed;" and, 1704, "Tentamen Medicinale," throw a good deal of light on the history of pharmacy.

1724.—Public papers of the 13th, 14th, 15th, and 16th of June contain the following paragraphs:—"On Wednesday last, the four censors of the College of Physicians, and the two wardens of the Apothecaries' Company, visited several chymists, druggists, and apothecaries' shops, pursuant to the authority granted them by a late Act of Parliament, and we hear they burnt several drugs and other things in the medicinal faculty, before the doors of Mr. Goodwin, chymist, facing the Haymarket, the corner of Pall Mall," &c. It is only fair to Goodwin's memory to state that he seems to have been the victim of spite, and that he recovered £600 damages for the injustice he had sustained.

1732.—In this year, Boerhaave, of Leyden, published the celebrated two thick quarto volumes, which, Rodwell says, was for many years the chemical text-book of Europe. What was chemistry at this date? It was what we should term pharmaceutical chemistry. Who were the chemists who followed this chemistry? Men whom we might term pharmaceutical chemists. Show this first text-book of chemistry to any intelligent man of the present day, without allowing him to see the title-page or the physical sections, and he would say, "This is an old book on pharmacy." Boerhaave possessed the scientific spirit; he sought to discover "the causes" of chemical changes, but he rightly treated the chemistry of his day as an art. One quotation will suffice. It is from page 49 of the English translation, by Dallowe, 1735, a copy of which is in the Pharmaceutical Society's library. "The effects of this art the chemists have reduced principally to four *classes*; which are all produced either by adunation, or separation. When, for instance, they resolve a body into any distinct part which they collect and separate from it, they call this operation extraction, and to those parts chiefly which are the most considerable they give the name of an *extract*. Thus, when they draw from wormwood the penetrating bitter part only, they call it the extract of wormwood; as the most subtil part of iron artificially separated from it goes always by the name of extract of iron. Hither, therefore, are referred a great number of operations, which may be performed on the same body, as distillation with water, or without it; decoction, and the inspissation of this decoction through different degrees; tinctures, let the *Menstruum* made use of be what it will; &c."

I do not mean to say that Boerhaave recognised no man as a chemist unless he were a maker or vendor of chemicals, for he says (vol. ii., page 2) "Nothing has prov'd more fatal, both to the chemical and medicinal art, than an idle opinion, that all kinds of chemical productions were proper to be made use of as medicines." Still the opinion, though idle, was the opinion, and it was Boerhaave himself who did so much to correct it, by showing that, although the chemical art "furnishes us with proper help for securing and restoring of health," it also "opens to the human mind the powers of nature." At the same time, however, Boerhaave apparently regarded the makers and vendors of chemicals and drugs as *the* chemists; for he reproved those of "the chemists" who practised physic without sufficiently understanding it, while he also hoped that "Gentlemen of the faculty, who are such enemies to the chemists, would consider this affair [the use of chemistry in medical practice] in a proper light; and then they would not so rashly condemn an art whose assistance may be of service to medicine, but cannot possibly do it any prejudice."

1748.—The Apothecaries' charter of this date was intended to restrain chemists and druggists from practising pharmacy, that is, compounding prescriptions. It failed. The apothecary (originally only "a preparer of drugs for medicinal uses") was then gradually becoming what to-day he is, namely, a medical practitioner, while the chemist and druggist was as gradually succeeding him as a preparer and compounder of medicines.

The foregoing information will probably suffice. The alchemist became the chemist. The drug-grocer became the druggist. The chemist and the druggist gradually amalgamated, afterwards, also, becoming a compounder of physicians' prescriptions. The whole of the chemistry of the time of Boerhaave, which he so well taught to his medical and other pupils, is embraced in what is modestly termed pharmacy in 1878. The only chemist of his day, s

regards knowledge, and commonly, also, as regards practice, was such a man as the chemist and druggist of the present day. Some physicians, as I have said, and a few men of wealth, worked at the art, and did much towards laying the foundations of the present structure of chemical science, but the men recognised generally as chemists 200 years ago are the men recognised as chemists by the great mass of the public now—the makers and vendors of chemicals, the "chemists and druggists." Those of them who date from 1868, many who date from 1842, and not a few of the older followers of pharmacy, claim to be not only makers and vendors of chemicals, but students of the science of chemistry. As a class, however, they know well that *now* there are in England chemists who more thoroughly study chemistry than necessarily they do, and they nearly always term themselves "chemists *and druggists*," or sometimes pharmacists: or, after passing a somewhat severe "Major" examination, they are allowed (and they only are now allowed) the title "Pharmaceutical Chemist."

One word to the "Credulous Chemist." I trust he will retain his conviction, *unshaken*, "that the designation of chemist pertains only secondarily to the student and worker, and primarily and distinctively to the dealer [may I add, and student also] in chemicals." If so, I would appeal to him to give—at some early date, and in any way he pleases—to give to his conviction the weight of his name. He would be doing an act of justice to "chemists and druggists," while to those other chemists, your readers, his opinion on the matter would, I am sure, be accepted as entirely conclusive.—I am, &c.

JOHN ATTFIELD.

Ashlands, Watford.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Bulletin de la Societe Chimique de Paris, No. 5, March 5, 1878.

Reaction Peculiar to Certain Polyatomic Alcohols.—D. Klein.—If borax and mannite be mixed in such proportions that less than ½ equiv. of borax is taken to each equiv. of mannite, the liquid is acid. If ½ equiv. of borax is employed, the liquid is neutral, but on treating the mixture with alcohol there remains a peculiar compound, the same as that produced on mixing the two substances equivalent for equivalent. The alcohol removes the excess of organic matter. If borax is added in excess, it crystallises, and the organic matter remains merely in combination with 1 equiv. of borax. If an aqueous solution of borax is poured into a concentrated solution of any of the following polyatomic alcohols: glycerin, erythrite, mannite, levulose, dextrose, and galactose (α and β), the polyatomic alcohol being in excess, an energetic acid reaction is immediately set up. The liquid turns blue litmus, the yellowish red shade characteristic of the more powerful acids, and the mixture attacks calcic and barytic carbonates. If the liquid is diluted with water, the blue colour of the litmus is restored. If any of the above alcohols is added to a dilute aqueous solution of boracic acid, too weak to redden blue litmus paper, an acid reaction is also developed, even if a solution containing merely 1-20000 of boric acid is brought in contact with mannite. With quercite, no similar reaction was obtained. The alkaline earthy biborates yield similar results to borax.

Reaction of Boric Acid in Presence of Mannite.—D. Klein.—Five c.c. of a solution containing 1-100000 of boric acid mixed with the same volume of a solution of mannite, containing 15 per cent., reddened blue litmus slightly, after a minute.

A Manganese Blue.—M. Gaston Bong.—This blue is obtained on igniting silica, and any compound of manganese, with baryta, or a mixture of soda and lime in an oxidising atmosphere. Either of the following mixtures may be used:—

Silica	3	or	Silica or kaolin	3	or 2
Soda-ash ..	6	,,	Barium nitrate		8
Carb. of lime (free from iron)	5	,,	Oxide of manganese (free from iron)		3

The proportion of manganese affects the intensity of the blue, but not its tone. By increasing the proportion of alkali or silica, a green or a violet tone is produced. The use of potassa does not give good results. The ignition should be effected at a red heat, in the absence of reducing gases. These facts lead to a very delicate process for detecting the presence of manganese, especially in earthy substances. If to one of the above mixtures, made of materials free from manganese, any substance containing a trace of that element is added, a blue colour appears on ignition.

Chrome Blue.—M. Gaston Bong.—The following materials are intimately mixed and strongly calcined with free access of air:—

Boric acid	15 parts.
Alumina..	15 ,,
Carbonate of magnesia	20 ,,
Chromate of baryta	2 ,,

Transformation of Bromated Hydrocarbons of the Ethylen Series into Bromides of Acids of the Fatty Series, by the simple addition of Oxygen.—E. Demole.—The author describes the action of dry oxygen upon dibromated ethylen, the preparation of tribomated ethylen and its behaviour with oxygen. (Rusian Chemical Society, Session Nov. 13/25, 1877. Noticed elsewhere.)

Biedermann's Central-blatt, Heft 11, November, 1877.

Use of the Waste-Waters of Starch Works for the Irrigation of Meadows.—C. de Leeuw.—The author reports that this very offensive liquid has been found useful for the purpose mentioned.

Influence of the Surface of Leaves upon the Evaporation of Plants.—Dr. F. Tschapowitz.—The amount of evaporation rises and falls with the total amount of leaf-surface. Large leaves, however, seem to have a relatively greater evaporating power than small ones.

Discolouration of Green Leaves in Intense Sun-Light.—Prof. J. Böhm.—There is a maximum intensity beyond which the action of light upon vegetation is injurious. In such cases leaves are first bleached, then turned brown, and of a metallic lustre, and finally destroyed. The under surface of leaves is much more sensitive than the upper.

Nitrogenous Constituents of Feeding-Beets.—Prof E. Schulze and Dr. A. Urich.—The most important of these reserves of nitrogen are amides—glutamin and asparagin—and betain.

Cultivation of Sugar-Beets.—A. Ladureau.—A hectare of good land without manure gave 48,000 kilos. roots with 10·80 per cent of sugar in the juice; manured with the drainage of dung-hills, 61,500 kilos., with 10·25 per cent. Soda saltpetre brought the percentage of sugar down to 8·36; earthnut cake to 9·61, and complete chemical manure to 10·07. The chemical manure was very useful in destroying insects.

Comparative Experiments on the Formation of Fructose from Sucrose and Sulphuric Acid.—Fr. Anthon.—The most favourable results were obtained by

boiling cane-sugar for forty-five minutes with twice its weight of water and 1 per cent of sulphuric acid.

Solubility of Magnesia, Baryta, and Sulphate of Lime in Solutions of Sugar.—H. Pellet.—Magnesia is not quite insoluble in saccharine liquids; baryta is more soluble than in water. At ordinary pressure the solubility of calcium sulphate in water is little affected by the pressure of sugar.

Investigations on the Manufacture of Alcohol.—M. Delbruck.—An extensive memoir not suitable for abstraction.

Detection of Foreign Colouring Matters in Red Wines.—Profs. Nessler, Gautier, Hilger, Griessmayer, and Vogel.—A variety of methods are proposed, most of which are already known. Sulphate of copper is said to remove the colour of pure wines, leaving that of sophisticated samples unchanged.

Determination of Nitrogen in Albumenoid Substances.—A collection of the opinions of a great number of chemists on the relative value of the methods of Dumas and of Will and Varrentrapp.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 7, February 14, 1878.

It is proposed to display two electric lights on the towers of Notre-Dame during the approaching Exhibition.

During the past year 10,619 horses, mules, and asses have been used for human food in Paris.

Mania metaphysica (Grübel-sucht) is recognised as a new form of mental disease. It shows itself chiefly in young people in constant and useless inquiries into the why and wherefore of things, and is to be treated by small doses of potassium bromide.

Support for Regulating the Production of Gases (Hydrogen and Carbonic Acid).—H. Sainte-Claire Deville.—This apparatus cannot be described without the aid of the accompanying cut.

Note on the Telephone.—A. Demoget.—The author calculates that the sound transmitted by the telephone is 1,500,000 times weaker that that emitted by the speaker. He considers that as a machine it is still very imperfect.

Revue Universelle des Mines, de la Metallurgie, &c.,
November and December, 1877.

This issue does not contain any chemical matter.

MEETINGS FOR THE WEEK.

MONDAY, April 1st.—Medical, 8.
— London Institution, 5.
— Royal Institution, 2. General Monthly Meeting.
TUESDAY 2nd.—Civil Engineers, 8.
— Royal Institution, 3. "Protoplasmic Theory of Life, and its Bearing on Physiology," Professor Garrod.
— Zoological, 8.30.
WEDNESDAY, 3rd.—Society of Arts, 8. "Our Wealth in Relation to Imports and Exports, and the Causes of Decline in the Latter," Mr. Ernest Seyd.
— Geological, 8.
— Microscopical, 8.
— Pharmaceutical, 8.30.
THURSDAY, 4th.—Royal, 8.30.
— Royal Institution, 3. "Chemistry of the Organic World," Prof. Dewar.
— London Institution, 7.
— Chemical, 8. "On the Application of the Microscope to some Special Branches of Chemistry," H. C. Sorby, F.R.S.
FRIDAY 5th.—Royal Institution, 8. Weekly Meeting. "The Philosophy of the Beautiful," Mr. G. J. Romanes, 9.
— Geologists' Association, 8.
SATURDAY, 6th.—Royal Institution, 3. "On the Clavecinists of England, Italy, France, and Germany, and their Works," with Musical Illustrations on the Harpsichord and Pianoforte, Prof. Pauer.

Mr. WATTS'S DICTIONARY OF CHEMISTRY.
Complete in 7 vols., medium 8vo., price £10 16s. 6d.

A DICTIONARY of CHEMISTRY, and the Allied Branches of other Sciences. By HENRY WATTS, F.R.S., assisted by eminent Scientific and Practical Chemist

"The greatest work which England has yet produced on chemistry—one of the greatest, indeed, which she has produced upon any scientific subject—is finished at last, and we are able to congratulate Mr. Watts most sincerely upon its completion."—*Chemical News.*

"The English language is not rich in lexicons of science: we would point to this work as a model upon which others might be framed. It certainly exhausts the subject up to the date of publication, and therefore forms as it were the balanced ledger of the chemist."—*Athenæum*

London: LONGMANS and CO.

Now ready, 8vo., cloth, 30s.

PHOTOGRAPHED SPECTRA. One Hundred and Thirty-six Photographs of Metallic, Gaseous, and other Spectra, printed by the permanent autotype process, with Introduction, Description of Plates, and Index; and with an extra plate of the Solar Spectrum (showing bright lines), compared with the Air Spectrum, by J. RAND CAPRON, F.R.A.S.

London: E. and F. N. SPON, 48, Charing Cross.
New York: 446, Broome Street.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

THE TELEPHONE.

Arrangements for Exhibiting or Fixing on application to EDWARD PATERSON, Telegraph Engineer, 3, Bedford Court, Covent Garden, W.C. Insulated Wires, Call-Bells, Insulators, and Galvanised Wire for Overhead Lines. Electric House-Bells, and all descriptions of Electrical Apparatus for experimental and other purposes. Price list post free 2 stamps.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing are Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for udents, Schools, Colleges, &c.
NEW PATTERNS OF GEOLOGICAL HAMMERS.
EW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
83, CHARLOTTE STREET, FITZROY SQUARE.

PATENTS. PATENTS.

ROBERTSON, BROOMAN, and Co. (established 50 years) continue to obtain Patents for Inventions. Pamphlet containing special advice, gratis or by post.—166, Fleet Street London.

CARBIDE OF IRON (made by heating iron oxide and charcoal together) for filtering water commercially.—Send price per cwt. to R. May, 30, Haverstock Street, City Road, London.

THE SLATE RANGE BORAX COMPANY (LIMITED).—To be SOLD, the valuable DEPOSIT of BORAX, LAND, and WORKS, situated in the Brier Borax Mining District, county of San Bernardino, state of California. The Property consists of about 640 Acres of Land. Nearly the whole surface is crude Borax. A small portion has been worked, and is equal in quality to any manufactured in California or Nevada. The Works, erected about twelve months, are capable of producing ten tons per month. By additional outlay this may be increased to 100 tons per month. A railway runs about 70 miles from the Property; another is being constructed, which will reduce the distance to about sixteen miles. An offer is made to contract to produce the borax at one cent per pound to include all expenses. The Property is held from the United States Government, and entered in the books of the State, and subject only to the payment of the State taxes.—Tenders received up to 1st May, 1878, by the Liquidator, George Beech, 9, Temple Row, Birmingham

THE CHEMICAL NEWS.

VOL. XXXVII. No. 958.

SHORT REPORTS FROM THE CHEMICAL LABORATORY OF TRINITY COLLEGE, BUBLIN.

By J. EMERSON REYNOLDS, M.D.
Professor of Chemistry, University of Dublin.

No. V.

ON THE RAPID ESTIMATION OF UREA.*

A DISTINGUISHED physician, who wished to make frequent determinations of the urea daily excreted by a patient, requested me to devise a method which would enable him to make the desired estimation—(*a*) rapidly, (*b*) with sufficient accuracy for ordinary clinical purposes, (*c*) with simple and easily constructed apparatus, and (*d*) without the use of a balance or of any measuring vessels other than the fluid ounce and minim measures which a medical man is in the habit of employing.

This interesting practical problem was solved in the manner I shall presently describe, and the results obtained by the use of the method devised have been so satisfactory as to lead me to expect that it may be found generally useful where a high degree of accuracy is not desired.

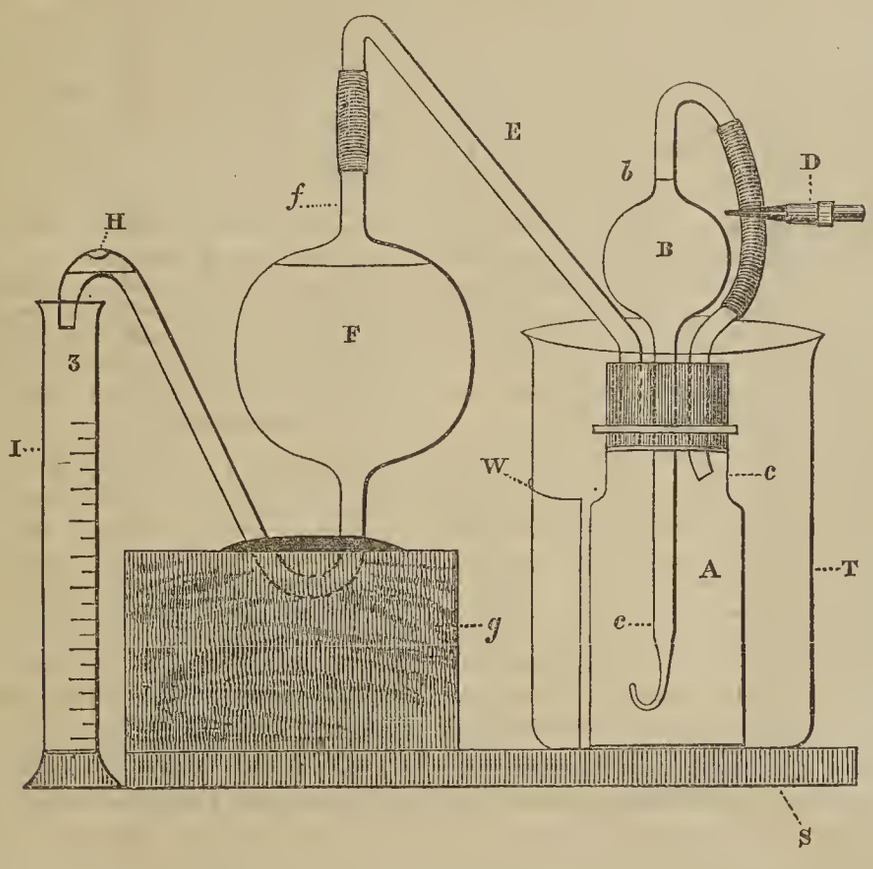
Before concluding this paper, however, I propose to describe a less simple plan for the estimation of urea than that just referred to; but one which is capable of affording results of greater precision.

In both the methods mentioned I take advantage of the now well-known reaction of sodic hypobromite with urea. When a strongly alkaline solution of sodic hypobromite is added to a liquid containing urea, the latter suffers rapid decomposition into water, carbonic anhydride, and pure nitrogen gas. The carbonic anhydride is not evolved as gas, but is absorbed, with formation of sodic carbonate, by the free alkali of the liquid used to effect decomposition; the nitrogen is evolved in the gaseous condition, and its bulk determined either indirectly or directly, the volume of nitrogen produced thus serving as a measure of the urea from which it was derived.

The equation which expresses the change just referred to is the following:—

$$\underbrace{CO''N_2H_4}_{\text{Urea}} + \underbrace{3(NaBrO)}_{\text{Sodic Hypobromite}} + 2(NaOH) = 3NaBr + Na_2CO_3 + 3H_2O + 2N.$$

The use of calcic hypochlorite, or solution of "chloride of lime," in effecting a similar decomposition was pointed out by Dr. E. W. Davy,* and it has been recently shown by Yvon† that the hypochlorite used by Davy is more effective than the sodic hypochlorite, but it does not evolve the whole of the nitrogen and is irregular in its action. Knop, and after him Hüfner,‡ and many others, have shown that the sodic hyprobomite is greatly to be preferred to any of the hypochlorites, as the decomposition of urea is almost complete, and progresses regularly and rapidly without the aid of heat; hence I use the hypobromite as the basis of the plan of operating now to be described, and in this respect agree with Hüfner, Russell and West, R. Apjohn, Blackly, (Dupré, and with Simpson and O'Keefe)§ in the methods they have proposed for urea estimation.



The different methods devised by the above-named chemists all serve for the *direct* measurement of the volume of nitrogen evolved during the action of the hypobromite on urea, and involve the use of specially graduated tubes for the reception and measurement of the pure gas. My plan is essentially different, as the gas evolved, which is scarcely soluble in water,‖ is made to

* Read March 19th, 1877.

* *Journal of the Royal Dublin Society and Phil. Mag.*, [4], vol. vii., p. 403.
† *Journal de Pharmacie et de Chimie.*, [4], vol. xxiv.
‡ *Journal für Praktische Chemie.*, [2], vol. iii., p. 1.
§ Published since this paper was read.
‖ According to Bunsen, water dissolves only 0·01478 of its volume at the mean temperature and pressure ("Bunsen's Gasometry," p. 286).

displace its own volume of that liquid, and the latter is then easily measured in any ordinary vessel, such as a tall and well graduated drachm measure.

The apparatus may be most conveniently described as consisting of two distinct parts—A, the generating vessel (see annexed woodcut, Fig. 1), and F the small gas holder from which water is expelled by the nitrogen entering from A.

Gas Generating Vessel.—This is an ordinary two-ounce wide-mouthed bottle, fitted with a good india-rubber cork, pierced with three holes. Through one of these holes the gas delivery tube E passes, and through another the small piece of bent glass, tube C. The heat afforded by a spirit lamp suffices for bending these tubes from straight pieces, and for the conversion of an ordinary bulb pipette capable of holding rather more than one fluid ounce into a vessel of the form B.

The delivery tube of the pipette is first passed through the remaining hole in the cork, and the end of the tube then drawn out and recurved, as shown at *e*; the tube above *b* is bent so far down as to admit of its being connected by means of an india-rubber tube with the outer extremity of C. At D the india-rubber tube is securely clipped by a small artery forceps with broad jaws. When the cork carrying the tubes just described is secured in the bottle, the generating vessel is complete. When an estimation is in progress the bottle A is placed in a tumbler T (or beaker), containing cold water at a temperature of 52° F., as nearly as possible.

The Gas Receiver.—This is easily constructed from a large pipette whose bulb, F, is capable of containing about three fluid ounces. The tube *f* is cut off so as to admit of being securely joined to the tube E of the generating vessel by means of an india-rubber connector. The delivery tube is then bent, as shown, and at the point H a little hole is made. A groove cut in a block of wood *g* receives the bent tube of the little gas holder, which is then easily secured in its place by any suitable cement—common sealing wax, for example. Thus, with the aid of the two pipettes, cork, and tubing, which can be easily procured through a druggist for about 3s., a medical man can construct his own ureometer.*

When in use the block *g* is secured to the board S on which the beaker T stands held by the wire W.

Mode of Using the Apparatus.—The vessels A and F are disconnected, and F filled with water until it overflows and the excess has ceased to drip from the tube under H. The cork is removed from the bottle A, and two fluid drachms of the liquid to be tested measured off in a tall minim measure, and then poured into A; one drachm of water is next used to rinse the liquid adhering to the sides of the measuring glass into the bottle A; the total volume in A therefore should measure about three drachms.† For a reason which will presently appear, it is desirable that no more water than one drachm should be employed. If a pipette delivering two drachms be used, a drachm of water should be added; but the pipette need not be rinsed with it. The next step is to fill the pipette B with the reagent which evolves the nitrogen of the urea. For this purpose a suitable vessel—a wine-glass for example—is filled with the hypobromite liquid;‡ the forceps D are removed from the india-rubber tube, but are placed close at hand, and a piece of vulcanised tubing, five or six inches long, attached to the end of the glass tube C; suction is then applied by the mouth, when the curved end *c* of the pipette is immersed in the hypobromite. The pipette is thus easily filled by suction with the reagent up to the mark *b*. The forceps D are next applied to the connector, as shown, *before* the lips are withdrawn from the india-rubber tube attached to C; the suction tube may then be removed from *c*, as the liquid is retained in B by atmospheric pressure, provided D pinches the tube well. Having washed the end *c* by pouring a little water over it, the cork carrying all its apparatus is securely inserted in the bottle A, the latter placed in the beaker T containing enough water to cover the cork when A is pressed down, and the tube E securely connected by the tightly-fitting india-rubber tube with *f*. While connecting the generator and receiver a little water is necessarily expelled from the tube beyond H, but this water is thrown away and the *dry* two-ounce measure I then placed under the spout.

Up to this point the hypobromite has not been allowed to come in contact with the urine, but now on removing the forceps D the hypobromite flows out from *c* and rapidly mixes with the urine, the urea of which yields up its nitrogen gas with effervescence. As the gas evolved has no exit save through E it displaces from F its own volume of water, which falls into the vessel I, and can then be measured, when no more water is expelled. The effervescence ceases after five or ten minutes, according to the temperature.

It is essential to good measurement that the pressure within the apparatus should be the same at the end as at the beginning of the experiment; in order to secure this, the simple plan is adopted of placing a wedge under the board S at the end indicated, which is thus so tilted that the eye placed at a point a little below D, and looking immediately above the surface of the water in F, can just see the bend of the tube under H. When the pressure within and without has been thus equalised the amount of water expelled is the measure of the nitrogen evolved in A, for we may in a test of this kind neglect the extremely minute proportion of the nitrogen which has been dissolved by the water.

When it is desired to correct for temperature and pressure, by means of the usual formula, it is now necessary to disconnect E and *f*, and to pass the bulb of a small thermometer through *f* into the gas over the water in F; after a minute or so the temperature may be read off and recorded, and the barometric reading made at the same time. In ordinary clinical experiments, however, the correction for temperature may be neglected when a thermometer in the room stands near to 52° F. The neighbourhood of a fire or stove must be avoided in making the estimations of urea.

In measuring the water expelled we may either read off the volume in drachms or sixths of a drachm; but since ordinary cylindrical two-ounce measures are rarely graduated to less than half drachms, the *best* plan is to pour the excess over a definite number of drachms into a tall two-drachm measure, bearing in mind that every ten-minim division represents the sixth of a drachm.

I find as the result of a large number of direct experiments with a standard solution of pure urea, some of which will be given farther on, that *one grain of urea produces sufficient gas at a temperature of* 52° *F. and a barometric pressure of* 30·06 *inches to expel* 6⅔ *drachms of water*, the volume of liquid in the bottle A being three drachms, and the hypobromite added ten drachms.

It may be mentioned that measures of capacity need not be employed in the determinations of urea, as the water expelled may be received in any suitable vessel which has been previously weighed. At the end of the experiment the vessel and expelled water are weighed. When the estimation was made under the condition above named *one grain of urea was found to expel, as a mean,* 365 *grains of water by weight.* This number is easily remembered, as it happens to be identical with the number of days in a year.

Effect of the Degree of Dilution upon the Determination of Urea.—An apparently trifling observation led me to examine the effect of dilution upon the yield of nitrogen

* Messrs. Yeates and Son, of this city, supply a neat form of my apparatus ready for use.

† The measures used should be good, the two-drachm and two-ounce vessels agreeing with each other. The amount of reliance which can be placed upon the results depends in great part on the accuracy of the measures.

‡ This solution is prepared as follows:—Dissolve 4 ounces of the solid caustic soda of the shops in 10 fluid ounces of water. When the soda has dissolved and the liquid cooled to 60° F., add gradually one fluid ounce of bromine. The test solution is then ready for use. It should be kept in a cool place, and away from the light.

obtainable from a constant weight of urea, and the results arrived at are stated in the table given below.

The quantity of pure dry urea operated with in each of the following experiments was 2·222 grains, and the same volume (*i.e.* ten fluid drachms) of a single sample of freshly prepared sodic hypobromite was added in each case. The experiments were completed within three and a half hours, and care was taken to avoid changes of temperature as much as possible; hence, while the barometer remained steady at 30·06 inches, the temperature varied within such very narrow limits (between 50° and 52° F.) that corrections for alterations of volume were unnecessary, as extreme accuracy in the measures of the water expelled was not attainable with the vessels advisedly employed, as I desired the results to be of such a kind as a medical man could easily obtain in his own study.

Table.

Experiment No.	Pure, dry Urea used in Experiment.	Volume of Water used to dissolve Urea in A.	Volume of Water expelled from F.
1 ..	2·222 grains,	0 drachm,	15⅛ drachms.
2 ..	,,	1 ,,	15 ,,
3 ..	,,	2 ,,	14⅝ ,,
4 ..	,,	2 ,,	14⅝ ,,
5 ..	,,	3 ,,	14⅜ ,,
6 ..	,,	3 ,,	14⅜ ,,
7 ..	,,	4 ,,	14⅜ ,,
8 ..	,,	5 ,,	Lost.
9 ..	,,	6 ,,	14 + ,,
10 ..	,,	7 ,,	13⅞ ,,
11 ..	,,	8 ,,	13⅝ ,,
12 ..	,,	9 ,,	13⅜ + ,,
13 ..	,,	10 ,,	13⅛ + ,,

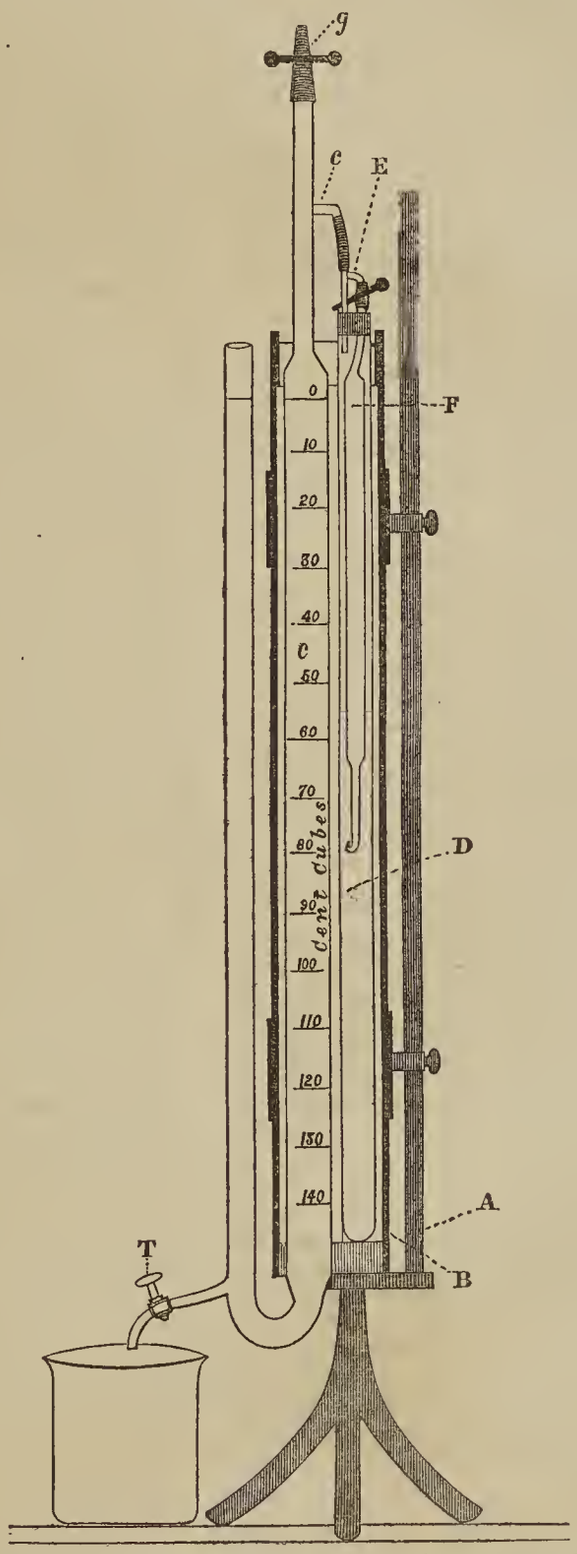
The weight of urea taken for each experiment is capable of affording a volume of moist nitrogen gas at the temperature and pressure above stated, which would expel 15⅜ drachms of water. The maximum volume obtained from that weight of pure dry urea was 15⅛ drachms. Thus there is a minimum loss of 3·3 per cent. The maximum observed loss in the foregoing experiments amounted to 14·9 per cent., and occurred in the experiment in which the above-named weight of urea was dissolved in ten drachms of water. The loss within the above limits is tolerably regular, as the volume of nitrogen is diminished by ⅛th of a drachm (nearly) for each drachm of water added to the urea in the decomposition vessel A.

The loss of nitrogen referred to is, doubtless, due in part to solution of the gas, but it is chiefly attributable to the regular diminution of the strength of the oxidising agent used—the hypobromite solution—and to a corresponding increase in the extent of the secondary changes which are known to occur in the diluted liquids, and which involve a loss of gaseous nitrogen. Much of the error arising from the latter cause is avoided by adopting the plan of employing a constant volume of liquid: hence the recommendations already made that two drachms of urine should be measured into the bottle A, and the measure rinsed out with not more than one drachm of water. The total bulk of liquid in A ought then to measure as nearly as possible three drachms. Even when the sample to be tested is measured with a pipette, it is well to add one drachm of water from an ordinary measure in order to bring up the total volume of liquid to the amonnt recommended.

When the simple precautions are taken which I have already mentioned, the little apparatus described in this paper will enable a considerable number of estimations of urea to be made with rapidity, and with sufficient accuracy for ordinary clinical purposes. When very precise determinations are required, Liebig's process must be resorted to, as all the methods in which hypobromites or hypochlorites are employed are liable to the errors pointed out above; the accuracy of the results are also affected by the action of the reagent used on uric and hippuric acids, creatinine, and other nitrogenised compounds. On the other hand, when we desire to ascertain the total amount of nitrogen excreted by the kidneys, it is necessary to resort to the precise method of estimation which I communicated to the Surgical Society of Ireland.*

Estimation of Urea by Direct Determination of the Nitrogen Gas Evolved by Sodic Hypobromite.

The piece of apparatus now to be described was exhibited at a meeting of the Scientific Club in 1871, and has proved most useful for the estimation of urea by the hypobromite method, and, with a little modification, for



the estimation of carbonic acid in carbonates, and for other similar purposes. I shall only refer at present to its use in ureometry. In this apparatus the nitrogen evolved is directly measured as gas under conditions which admit of very accurate determinations of volume in cubic centimetres.

* *Vide Medical Press and Circular*, May 13, 1874, p. 402.

The apparatus is shown in section in Fig. 2. The stand A supports a tall glass cylinder B. Through the large india-rubber cork which closes the lower opening of the cylinder the U tube *c* is passed, great care being taken to avoid breaking the small T connector *c*. The outer limb of the U tube is provided with a glass tap T. The limb within the tall glass cylinder is sufficiently wide to contain 150 cubic centimetres in the expanded portion, which, in my apparatus, measures sixty centimetres in length. The graduation cannot be conveniently carried beyond fifths of a cubic centimetre. At the point shown an india-rubber tube *g* is attached, which can be closed at will either by a good clip or by a stopper of glass rod. The glass side tube *c* serves to connect the measuring apparatus in the manner shown with the generating vessel D, which is a long and wide glass tube placed within the cylinder. The glass T tube E is connected by means of rubber tubing with *c*, while one limb passes through the india-rubber cork of D, and the other is connected by another piece of rubber tubing with the fine tube of the long pipette F (of about 20 c.c. capacity), which projects through the cork. This connection must be sufficiently long to admit of the clip being applied as shown.

The large glass cylinder B is filled with water, in order to maintain a steady temperature, the value of which can be be known by means of a thermometer immersed in the water.

A determination is made with this apparatus in the following way:—Having disconnected the T tube E from *c* and the clip, the generating tube D is taken out of the water of the cylinder, the cork carrying the pipette, &c., withdrawn, and then five cubic centimetres of the urea solution introduced into the tube D. Before replacing the cork the pipette F is filled with hypobromite solution by suction above E, while the small glass tube opening on the under side of the cork is closed by a finger; the clip is then applied. The exterior of the pipette is now washed with a little water, and the cork, with the apparatus attached, is then replaced in position; the tube D again immersed in the water of the large cylinder, and the connection between E and *c* securely made. Before making the connection the water in the graduated tube should stand at the zero of the scale, but after making the joint the pressure within the apparatus is usually greater than that without. As the air in the tube D cools down to the temperature of the surrounding water, contraction takes place; but should the water not return to the zero, equilibrium is at once restored by opening the fine india-rubber tube *g* for a few seconds, and then closing in such a manner as to prevent any possible escape of gas.

The hypobromite is brought in contact with the urea solution by removing the clip from the india-rubber tube connected with the pipette; the reagent then falls from a considerable height, and mixes thoroughly with the liquid at the bottom of the tube D. Nitrogen is evolved and displaces water from *c*, the water being maintained at the same level in both limbs of the U tube by allowing the liquid displaced to run off by means of the tap T. When the evolution of gas has ceased, the water level is adjusted by means of the tap, and the volume of gas produced in the reaction then read off on the graduated tube *c*; the temperature of the water in the cylinder B is then ascertained, as well as the height of the barometer at the time. From the data thus obtained, the volume of dry nitrogen at 0° C. and 760 m.m. can be easily calculated by the usual formula.

THE ATOMIC WEIGHT OF GALLIUM.

At the meeting of the *Academie des Sciences* on the 25th ult., M. Lecoq de Boisbaudran announced that he had prepared several anhydrous chlorides, bromides, and iodides of gallium. He has also determined the atomic weight of the new metal. The mean of two experiments showed it to =69·9.

ON THE

SULPHATES OF THE VANADIUM PENTOXIDE.

By Dr. B. W. GERLAND.

(Concluded from page 128).

Basic Vanadylic Sulphate, $V_2O_2,O.2SO_4$.—The solution of vanad-pentoxide in a large excess of sulphuric acid—which, as just shown, deposits crystals of the neutral vanadylic sulphate at the temperature of boiling vitriol—forms, when kept for a length of time at 130° to 150°, crusts of crystals of different appearance. They are hard and heavy, opaque, and of bright red colour; they deliquesce in air to a clear brown liquor, which can be mixed with water without decomposition; but heating, and even time alone, causes separation of amorphous vanadic acid retaining a small amount of sulphuric acid. In contact with liquid water this decomposition immediately takes place. These crystalline crusts were crushed, and left between porous stones in a dry atmosphere. The analyses of three preparations yielded the following results:—

(1.) 0·8359 grm. substance gave $BaSO_4$, 1·2099 grm. V_2O_5=10·7 c.c. permanganate solution (1 c.c.= 0·03748 grm. V_2O_5).

(2.) 1·0264 grm. substance gave $PbSO_4$, 2·0497 grm.; V_2O_5=12·1 c.c. permanganate solution.
0·8759 grm. substance gave H_2O, 0·0430 grm.

(3.) 0·8094 grm. substance gave $PbSO_4$, 1·5574 grm.; V_2O_5, 0·3937 grm.; and K_2SO_4, 0·0072 grm.

Calculated for	(1.)	(2.)	(3.)	Calculated for $V_2O_2,O,2SO_4$.	Calculated for $V_2O_2,H_2,2SO_4$
V_2O_5 ..	47·97	44·19	48·64	53·30	50·63
SO_3 ..	49·69	52·72	50·80	46·70	44·37
K_2O ..	—	—	0·88	—	—
H_2O ..	—	4·90	—	—	5·05
		101·81		100·00	100·00

These analyses show that no pure compound was obtained, but that the crystals formed in the solution of vanad-pentoxide in a large excess of sulphuric acid at a lower temperature contain less sulphuric trioxide than those octahedrons deposited at the boiling-point of sulphuric acid. They also make it probable that the pure compound is anhydrous, and represented by the formula $V_2O_2,O,2SO_4$, and this is almost proved by the agreement of its properties with the pure substance prepared as described below. The formation of these crusts has been observed by Fritsche, but this author supposed it to be composed according to the formula $V_2O_2,O_2H_2,2SO_4$ (Liebig and Kopp, *Jahresbericht*, 1851, p. 351).

The compound $V_2O_2,O,2SO_4$ is obtained pure by heating the neutral salt to a higher temperature. At the temperature of melting lead the latter gives off fumes of sulphuric trioxide, which suddenly cease, and the residue then consists of a crystalline mass, with shining faces of dark red colour whilst hot, changing to brick colour on cooling. Its behaviour in the air and in contact with water is the same as that described of the crystalline crusts obtained from solution in sulphuric acid at 150°. Three preparations were submitted to analyses with the following results:—

(1.) 1·6509 grm. substance gave insoluble $V_2O_22SO_4$, 0·0405 grm.; $BaSO_4$, 2·2260 grm.; V_2O_5=23·31 c.c. permanganate (1 c.c.=0·03766 grm. V_2O_5.)

(2.) 0·8903 grm. substance gave insoluble $V_2O_22SO_4$, 0·0317 grm.; $BaSO_4$, 1·1968 grm.; V_2O_5=12·39, c.c. permanganate (1 c.c.=0·03766 grm. V_2O_5).

(3.) 0·7503 grm. substance gave insoluble $V_2O_22SO_4$, none; $BaSO_4$, 1·0053 grm.; V_2O_5=10·70 c.c. permanganate (1 c.c.=0·03748 grm. V_2O_5).

Calculated for	(1.)	Deducting $V_2O_22SO_4$.	(2.)	Deducting $V_2O_42SO_4$.	(3.)	Cal. for $V_2O_2O2SO_4$.
In. $V_2O_22SO_4$	2·45	—	3·56	—	—	—
V_2O_5	53·04	53·40	52·27	53·11	53·45	53·30
SO_3	46·29	46·60	46·15	46·89	45·95	46·70
	101·78	100·00	101·98	100·00	99·40	100·00

Double Salts of Vanadylic Sulphate.—A compound of vanadylic sulphate with potassium is readily obtained by mixing the solution of the former with the solution of a potassium salt. The mixture remains clear provided it is not more than lukewarm, and begins sooner or later, according to concentration, to separate crystals of the new compound. If sufficient potassium salt is present the solution ultimately retains only a very small amount of vanadium; but if the temperature is above 40° a slimy deposit appears, which gradually increases until the whole is gelatinised. The crystals are separated from the mother-liquor, quickly rinsed with small quantities of cold water, pressed between filter-paper, and dried over sulphuric acid. They are obtained from concentrated solutions in thick heavy crusts of amber colour, and from dilute acid solutions in single transparent individuals of bright sulphur colour. Water decomposes them; they do not change in the air, nor in dry air, but lose their water completely at 100°. According to the following analyses this new compound has the composition $K_2O,V_2O_5,2SO_3,6H_2O$. I have tried to obtain an alum by increasing the amount of sulphuric acid in the solution, and by otherwise varying the conditions under which the salt forms, but always obtained the same compound. The liquor obtained by deliquescence of the compound $V_2O_2,O,2SO_4$, mixed with a solution of potassium sulphate or chloride, also yielded the same compound. From dilute solutions containing much free acid, crystals of 2 to 3 m.m. length and great transparency are obtained. My friend, Dr. F. Hurter, has kindly undertaken the crystallographical examination. He has observed two crystallographical axes, but leaves it undecided whether the crystals are monoclinic or anorthic. The following analyses were executed with material of different preparations:—

(1.) 1·0000 grm. substance gave—
$PbSO_4$, 1·1031 K_2SO_4, 0·3025 V_2O_5, 0·3477

(2.) 0·9729 grm. substance gave—
$PbSO_4$, 1·1103 K_2SO_4, 0·2974 V_2O_5, 0·3064

(3.) 1·0008 grm. substance gave—
$PbSO_4$, 1·1458 K_2SO_4, 0·3155 V_2O_5, 0·3278 H_2O, 0·1936

(4.) 1·0006 grm. substance gave— H_2O, 0·1948
0·9980 grm. substance gave—
$PbSO_4$, 0·9006 K_2SO_4, 0·2390 V_2O_5, 0·2692

Calculated for	(1.)	(2.)	(3.)	(4.)	Calculated for $K_2O,V_2O_5,2SO_3,6H_2O$.
H_2O ..	—	—	19·36	19·48	19·82
V_2O_5 ..	34·77	31·49	32·78	33·73	33·52
K_2O ..	16·35	16·53	17·06	16·22	17·29
SO_3 ..	29·12	30·13	30·51	29·80	29·37
			99·71	99·23	100·00

This compound is decomposed by cold water, with separation of a brown amorphous substance; the yellow solution deposits more when warmed. The precipitate obtained by treatment of the crystals with cold water was filtered, washed with small quantities of cold water, pressed, and when dry submitted to analysis.

0·5550 grm. substance gave—
$PbSO_4$, 0·0126 grm. K_2SO_4, 0·0711 grm. V_2O_5, 0·4330

Calculated—

V_2O_5	78·02
K_2O	6·30
SO_3..	0·60
H_2O (by difference) ..	15·08
	100·00

A considerable portion of the potassium is therefore left in an insoluble compound with vanadium, and we may conclude from this that in the yellow crystals sulphuryl and potassium are both united to the vanadyle molecule by oxygen according to the formula—

$$V_2O_2,\begin{cases}O_2.K_2\\O_2.SO_2.\\O_2.SO_2\end{cases}$$

The vanadylic sulphate is acted upon by ammonium sulphate in a similar manner: the resulting compound, however, is without decomposition readily soluble in cold water, and the difficulties attending its purification are thereby much enhanced. The mixture of the concentrated solutions of these two salts has a greenish brown colour like that of the solution of vanadylic sulphate diluted with water. By slow evaporation over sulphuric acid soft crystalline masses of a brick-red colour separate, which appear under the microscope as bundles of parallel transparent needles, about 0·1 m.m. in length. The crystallisation was treated upon a Bunsen filter, twice mixed with a little water, and again sucked off, then—after pressing between filter-paper and drying over sulphuric acid—submitted to analysis:—

0·9528 grm. substance gave AmCl, 0·2292 grm.; $BaSO_4$, 1·0082 grm.; V_2O_5 = 109·1 c.c. permanganate solution (1 c.c. = 0·003070 grm. V_2O_5).

Calculated for		Calculated for $V_2O_5,Am_2O,2SO_3,4H_2O$.
V_2O_5	35·15	39·14
$(NH_4)_2O$	11·69	11·14
SO_3	36·67	34·29
H_2O (difference)..	16·49	15·43
	100·00	100·00

These figures represent approximately the formula $V_2O_5,Am_2O,2SO_3,4H_2O$; they show, however, that the new compound is formed, as was the potassium compound, by 2 mols. ammonium taking the place of SO_2.

The vanadylic sulphate does not seem to combine, nor to decompose itself with sodium sulphate. The solutions of the two compounds remain clear after mixing. Evaporated in the cold, crystals of Glauber salts are separated, tinged intensely yellow by a small amount of vanadic acid. They were recognised as $Na_2SO_4,10H_2O$ by analysis and crystallographically. A solution of vanadylic sulphate is decomposed by sodium acetate under gradual formation of amorphous vanadic acid, and from the filtered and evaporated mother-liquor sodium sulphate of intensely yellow colour crystallises. Magnesium sulphate behaves with vanadylic sulphate like sodium sulphate. When sufficiently concentrated the solution of the mixed salts deposits the former in its original shape.

These results again demonstrate the great energy with which potassium unites with vanadium compounds. I have shown on a former occasion that ammonium vanadate contains potassium if precipitated from solutions containing potassium; that the vanadylous sulphates cannot be freed from potassium if such was present in the acid liquor in which they formed, and shall shortly demonstrate that the vanadid-sulphates, V_23SO_4 and $V_2H_24SO_4,2H_2O$, behave likewise.

Macclesfield, December, 1877.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Anniversary Meeting, Thursday, March 30, 1878.

Dr. J. H. Gladstone, F.R.S., President, in the Chair.

The President in his Address, after referring to the general history of the Society during the last twelve months mentioned that the whole subject of the bye-laws had received the very careful attention of the Council. The verbal alterations recommended were very numerous, but the real alterations affected mainly the mode of electing Fellows and of appointing Auditors. The constitution of the Publication Committee has been entirely altered; it will for the future consist of six members in addition to

the five officers of the Society. Various arrangements have been made for expediting the publication of papers, and the editor has made a successful effort to bring the work of abstracting up to date. This has involved the printing of an extra number of the Journal, which is on the point of being issued. As the duties connected with abstraction are increasingly laborious the Society has determined to appoint a sub-editor, and has been fortunate in securing the services of Mr. C. E. Groves for the post. The "Research Fund" now amounts to £4000, already: two papers, resulting from assistance rendered by its means, have been received, viz., "On some Points in Chemical Dynamics," by Dr. Wright and Mr. Luff, and "On Certain Polyiodides," by Mr. G. S. Johnson. It is to be hoped that many other chemists, especially those to whom the pursuit of chemistry has become a source of wealth, will contribute handsomely to this important fund. Since the last Anniversary Meeting an independent institute of professional chemists has been formed and has been incorporated (October 2) under the title of the "Institute of Chemistry of Great Britain and Ireland," with the two following objects: (*a.*) "To promote and encourage a thorough study of chemistry, and all branches of science allied thereto, in their application to the arts, to agriculture, to public health, and to technical industry." (*b.*) "To adopt such measures as may be necessary for the advancement of the profession of chemistry, and particularly for the maintenance of the profession of the consulting and analytical chemist on a sound and satisfactory basis." It will thus be seen that the two societies are perfectly distinct, but may be mutually helpful; the President therefore wishes all prosperity to the new institute. Sixty-five papers have been read before the Society during the past year, and two lectures have been delivered. There are at present 965 Fellows; 49 have been elected during the past year. The Society has lost by death one eminent foreign member, M. Regnault, whose name is so well known by his researches on specific heat, &c., as well as R. Apjohn, late Prælector of Chemistry in Caius College, Cambridge, who died in his thirtieth year from the results of a fall from a bicycle; J. J. Griffin, the founder of the well known firm of chemical instrument makers; W. Gossage, alkali and soap manufacturer; T. Hall, late science master at the City of London School; E. L. Koch, M. Murphy, Dr. H. M. Noad, late Professor of Chemistry at St. George's Hospital, author of a "Manual of Electricity"; E. F. Teschemacher, of the firm of Denham Smith and Teschemacher.

A vote of thanks to the President for his able address was proposed by Mr. DE LA RUE.

Dr. FRANKLAND, in seconding the vote, referred to the establishment of the Institute, stating that he was at first anxious to have it founded in connection with the Chemical Society; this was found, however, to be impossible; and he was at one time afraid that a separate body might injure the interests of the Society; he was glad to say that his fears were groundless, and he had every reason to believe that the founding of the Institute would furnish the Society with many welcome Fellows.

The vote of thanks was put and carried.

The PRESIDENT, in returning thanks, said that he had endeavoured to do his best for the Society, and thanked the Members of Council, the Officers, and Fellows for their constant and unremitting kindness to himself.

The Treasurer, Dr. RUSSELL, then gave a statement as to the condition of the Research Fund. At the conclusion of the report it was announced that Mr. De la Rue had offered the sum of £100 to be given to the Research Fund on the condition that it was to be devoted to any one important research.

A vote of thanks to the Treasurer for his report and to Mr. De la Rue for his handsome donation was proposed by Dr. ODLING, seconded by Mr. NEISON, and carried unanimously.

The TREASURER then read his Report of the condition of the funds of the Chemical Society.

A vote of thanks to the Treasurer for his lucid and satisfactory statements was proposed by Mr. ABEL, seconded by Mr. E. RILEY, and carried unanimously.

Dr. ODLING then rose to move that the Report of the President be received.

Mr. NEISON, in seconding the motion, referred to the want of reagents in the Preparation Room, and the desirability of distributing the General Index of papers to all Fellows free of charge; he also made some remarks as to the present mode of electing and admitting Fellows.

In reply, Dr. RUSSELL said that there had been no demand for reagents, but if such a demand did arise there would be no difficulty in supplying them.

Dr. ARMSTRONG said that he always made a point of communicating, if possible, with authors so as to have any thing they might want ready for their use.

Mr. CROOKES then proposed a vote of thanks to Mr. Watts, "our talented and conscientious editor."

Mr. HOWARD seconded the vote, which was carried unanimously.

Before electing the Council, &c., Dr. ODLING asked the Secretary for information as to an alternative, which he ventured to designate an opposition, list which had been circulated; it was such an exact copy of the list issued by the Council that many Fellows thought that both lists had come from the same source.

Dr. ARMSTONG replied that the persons issuing the list were unknown to him.

Mr. RILEY thought that the name of the Fellow who issued the list ought to have been attached to it to prevent mistakes.

Mr. NEISON said that he had issued the list on his own responsibility, and that he much regretted if any one had been deceived by it. He thought, as he had proposed Mr. Kingzett at the last meeting, that every one would have known where the list came from; besides, an additional name on the list would have rendered the balloting paper illegal.

The election of Officers was then proceeded with, Messrs. Beale and Thomson having been appointed scrutators. The following were elected:—

President—J. H. Gladstone, Ph.D., F.R.S.

Vice-Presidents—F. A. Abel, C.B., Sir B. C. Brodie, W. De la Rue, E. Frankland, A. W. Hofmann, W. Odling, Lyon Playfair, A. W. Williamson, T. Andrews, W. Crookes, F. Field, N. S. Maskelyne, H. E. Roscoe, R. Angus Smith.

Secretaries—W. H. Perkin, H. E. Armstrong.

Foreign Secretary—.Hugo Müller.

Treasurer—W. J. Russell.

Council—Lowthian Bell, M. Carteighe, A. H. Church, W. N. Hartley, C. W. Heaton, D. Howard, G. Matthey, E. Riley, W. A. Tilden, R. V. Tuson, R. Warington, C. R. A. Wright.

The meeting then passed the bye-laws as amended by the Council with a few verbal alterations.

PHYSICAL SOCIETY.

March 30, 1878.

Professor W. G. ADAMS, President, in the Chair.

THE following candidates were elected members of the Society:—S. Bidwell, M.A., LL.B., W. Grant, E. Gurney, and J. H. Smith.

Mr. W. H. PREECE described Byrne's Pneumatic Battery, and exhibited some of the results that may be obtained by its means. It is especially devised with a view to provide the medical profession with a portable battery capable of producing a considerable amount of heat, as is required for cauterising operations. The negative plate consists of a very thin plate of platinum, to which a lead backing is soldered, and this is covered with a sheet of thick copper, also coated with lead, the whole being then covered with a non-conducting varnish, with

the exception of the exposed platinum plate. Such an arrangement is found to be advantageous in that it increases the conductivity of the negative plate. Two of these plates are arranged to face the zinc plate, as in Wollaston's form of cell, and the exciting liquid consists of 12 ozs. of bichromate of potash, 1 pint of sulphuric acid, and 5 pints of water. By using such a mixture the sulphuric acid attacks the zinc, and the three atoms of very loosely-combined oxygen exercise a depolarising effect, by absorbing the evolved hydrogen. A fine tube dips into the exciting liquid, and is so arranged that it conducts a current of air from a small pair of bellows against the face of the negative plate. By this means any bubbles of hydrogen are, as it were, brushed off, and the current obtained from a given electromotive force is materially augmented, since the resistance is diminished. Mr. Preece then referred to several old forms of battery in which such an agitating principle is introduced, notably those of Grenet, Chataux, and Camacho, and he went on to describe a series of experiments he has made with a view to ascertain the cause of the great heating and illuminating effects that could be obtained with the apparatus exhibited. He showed that the effects were due to the mechanical agitation of the liquid on the face of the negative plate, but whether the great production of heat in the battery and the great lowering of its internal resistance were chemical, thermal, or electrical effects remains for further investigation. By means of a small battery of four cells, in which the plates were 4 ins. by 2 ins., a length of 6 ins. of platinumwire, No. 18 (0·05 in.), could be heated to bright redness, and much more powerful effects were obtained by a large battery of ten cells made by Ladd. In this case about 2 feet of a No. 14 (0·089 in.) wire were heated, and it was shown that when connected with an 18-inch inductorium, kindly lent by Mr. Spottiswoode, sparks of over 17 inches could be obtained, but this length was reduced to about 8 inches on stopping the current of air. A similar effect was also very marked when the poles were connected with two carbon points, the light given out when the air-current was introduced being remarkably bright and steady.

Mr. Preece then exhibited an ingenious method of showing the vibrations of a telephone-plate to an audience, which has been devised by Mr. H. Edmunds. A vibrating plate is employed to break contact, as in Reiss's original telephone, and is introduced into the primary circuit of a small induction coil. The induced current is employed to illuminate a rapidly rotating Gassiot's tube, and on making and breaking contact by speaking into the resonator, an illuminated star is observed, the number of whose arms varies with the pitch of the note: with a very low note it may resolve itself into a single straight line.

Lord Rayleigh exhibited and explained an arrangement which he has employed with advantage in certain acoustical experiments in order to secure absolute uniformity in the rate of rotation of an axle. After referring to the mathematical principles involved in such a problem, he explained that the only hope of its solution lay in the employment of a vibratory movement, which by some suitable device must be converted into a motion of rotation. The axle whose motion it is required to maintain uniform is usually driven, at an approximately uniform rate, by means of a small horizontal water-wheel, or in some cases the electro-magnetic regulating apparatus presently described is sufficient by itself to supply the necessary power. At equal distances round the axle are arranged four soft iron armatures, which successively come in front of the poles of a horse-shoe electro-magnet placed in the circuit of a four-cell Grove's battery. The current is rendered intermittent by the following arrangement:—Passing into the body of a tuning-fork, vibrating about 40 times per second, it leaves by a small platinum stud, which is touched at each vibration of the fork. The current then traverses a second small electro-magnet between the prongs, and by this means the vibrations are maintained: passing to the magnet above referred to the current then returns to the battery. The velocity of the axle is such that it performs about one complete revolution for every four vibrations of the fork, and the exact adjustment is effected as follows:—If the driving power be just sufficient to produce the desired speed, the armatures will be so attracted by the magnet as to be exactly opposite to it at the middle of its period of magnetisation; and so long as this position is maintained the magnet will not (on the whole) affect it; but if a disturbance occur in the driving-power the armature will be displaced from its former position, and will be attracted by the magnet until the error is compensated. Besides the armatures, this axle also carries, concentric with it, a hollow metallic ring filled with water, and, as this possesses a certain momentum in virtue of its rotation, it will act as a drag, tending to check the velocity in case it increases, and in the converse manner when a diminution occurs. A blackened disk, perforated with rings of holes of various numbers, also rotates with the axle, and by placing the eye behind the ring of *four* holes, and observing a prong of the fork, it is easy to ascertain whether the uniformity is maintained, since in that case the prong will appear to remain stationary.

CORRESPONDENCE.

CHEMISTS AND CHEMISTS.

To the Editor of the Chemical News.

Sir,—Your readers must, I am sure, thank me for having stimulated Professor Attfield to justify my respect for his authority; and I am bound in all seriousness to admit that he has made out a case sufficiently strong at any rate to show that in regard to degree of credulity I am less well entitled than I thought to the designation of

A Credulous Chemist.

THE CHEMICAL SOCIETY.

To the Editor of the Chemical News.

Sir,—As a provincial Fellow of the Chemical Society, I wish to draw your attention to what seems a grave defect in the mode of election of the Council. It may or may not be desirable that the Council should recommend to the society a list of members for election, but to practically enforce their acceptance offends all our political instincts. I can hardly suppose that the bye-law of the society, of which a printed copy is sent with the voting papers, is designedly contrived to render the Council self-elective, but it is impossible to doubt that this is its actual result. It is true that any Fellow is at liberty to propose additional names, and that these nominations are to be read from the chair and publicly suspended in the Society's rooms. In a society, however, where a large majority of the members rarely attend the meetings, and where the elections are by voting papers, such a regulation is a mere travestie of fairness, while the names so proposed are excluded from the printed voting list. For the nominee of any unofficial member to have a chance of election it would be necessary to send a private circular to every Fellow; an undignified as well as an expensive proceeding.

I wish it to be understood that I have not the least objection to any member of the present Council, and many of its names are such as I must honour and respect, but its very excellence makes it the easier and more befitting for me to complain of what seems wrong in principle, without raising the suspicion of personal motive. I cannot but see that if the government of the society were to fall into the hands of any clique, incalculable mischief might be done before, under the present rule, the majority of the Fellows could take any effective action.—I am, &c.

Henry R. Procter.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 9, March 4, 1878.

Theory of the Telephone.—M. Th. du Moncel.—The vibratory plate of the recipient cannot merely be replaced by a very thick and massive armature without affecting the transmission of speech, but these vibratory plates may be formed of non-magnetic substances. The vibratory plate may even be totally suppressed without hindering the telephonic transmission provided the polar extremity of the magnet is placed close to the ear. Hence the vibrations which reproduce speech in the receiving telephone are principally produced by the metallic nucleus infolded by the coil. The vibratory plate serves merely to react for the production of induced currents when set in vibration by the voice, and by its reaction upon the polar extremity of the magnetic rod to reinforce the magnetic effects produced by the latter.

The Vibrations of Matter and the Waves of the Ether in Photo-Chemical Combinations.—M. Favé.—We may regard it as admissible, at least as a probable conjecture, that affinity ought to be exerted when bodies in apparent contact have accordant vibrations of a sufficient intensity to draw into one common movement elements hitherto separate. Whether the vibrations are infra-luminous or ultra-luminous, according to the position in the solar spectrum of the resulting ether-waves, they all share the property of determining chemical combinations by accordance when their *vis viva* has a sufficient intensity.

Investigation of the Atmospheric Resistance in the Torsion-Balance.—A. Cornu and J. B. Baille.—Not suitable for abstraction.

Influence of Electricity upon Evaporation.—M. Mascart.—The author has examined if the slow formation of vapours is modified by the influence of electrised bodies. A number of small evaporating capsules, communicating with the ground, and containing, some water and others moist earth, were placed beneath conductors kept in a constant electric state. The amount of evaporation was always increased beneath the conductors, whether the electricity was + or −, sometimes being even doubled.

Observations on Gallium.—MM. Lecoq de Boisbaudran and E. Jungfleisch.—Crystals of gallium are obtained by introducing into the metal, cooled to 10° or 15° below its point of fusion, a platinum wire supporting a portion of solid gallium. In three to ten seconds octahedra may be collected, scarcely modified at their summits by traces of the base *p*. If the crystals are not promptly withdrawn the metal becomes heated to near its point of fusion, the solidification is retarded, and the base *p* is developed so as to produce large tables. The crystals of gallium obtained, though brilliant, are hard to measure, their surfaces being slightly curved. Gallium is hard and scarcely malleable. It can be extended under the hammer, but it soon becomes brittle. It breaks in the direction of the crystalline cleavage on a shock, or if suddenly bent. The authors have only succeded in obtaining it in thin foil by fusion between hot plates of glass. After cooling and solidification the metal can be readily detached from the glass, especially under water. Notwithstanding its relatively great hardness it leaves distinct marks, of a bluish grey, upon paper. It preserves its lustre in a laboratory where the air is always loaded with acid vapours; it remains brilliant in boiled water, but tarnishes slowly in water containing air. When in a state of fusion it is of a white, like that of tin or silver. When crystallised gallium is thrown into hot water it crackles and lets bubbles of gas escape. Gallic oxide is soluble in ammonia to a considerable extent. The authors have prepared the anhydrous chloride, iodide, and bromide. In the cold chlorine attacks gallium briskly with a great evolution of heat. The product is scarcely yellowish and would probably be colourless in a state of absolute purity. It is crystalline, fusible between 70° and 76°, easily volatile and deliquescent. The action of bromine is less energetic, but it takes place in the cold and liberates heat. The properties of the bromide are very similar to those of the chloride. To obtain the iodide the aid of heat is necessary. The iodide readily retains traces of free iodine, and seems to undergo partial decomposition if heated too strongly.

Elastic Forces of Vapours given off by a Mixture of Two Liquids.—E. Duclaux.—Aqueous solutions of monatomic alcohols, in their distillation follow the law—

$$\frac{a}{\varepsilon} = m\frac{a}{a+e};$$

a and *e* being the volumes of alcohol and of water in the liquid heated, and *a* and ε the same volumes in the products of distillation.

Theory of the New Direct Vision Spectroscope.—M. Thollon.—Not adapted for abstraction.

Combustion of Gases.—P. Schützenberger.—An examination into the propagation of the combustion of gaseous mixtures in narrow tubes, and the circumstances by which it is influenced.

Two Allotropic Varieties of Magnetic Oxide of Iron.—H. Moissan.—Fe_3O_4, prepared at a low temperature by the calcination of hydrated magnetic oxide in an inert gas, has the specific gravity 4·86, is attacked by concentrated nitric acid, and is transfomred by roasting into ferric oxide. The magnetic oxide obtained at temperatures from 350° to 440° is not peroxidised on ignition in the air, is not attacked by nitric acid, and its specific gravity varies from 5 to 5·09.

Action of Boron Fluoride upon Anethol, and an Examination of the Hydrofluoride of Fluoride of Boron.—F. Landolph.—At ordinary temperatures anethol is instantly polymerised by the action of boron fluoride, but at the boiling-point the action is totally different yielding anisol, C_7H_8O, and a compound, $C_{11}H_{16}O$. The hydrofluoride of fluoboron, $BF_3,3HF$, is a limpid fluid which, in contact with moist air, is rapidly resolved into hydrofluoric and boric acids. Its vapour density (4 vols.) was found to be 4·79 or 4·65, theory indicating 4·42.

New Carbonated Cupric Liquid for the Determination of Glucose.—H. Pellet.—Pure crystalline copper sulphate, 68·70 grms.; Rochelle salt, 200·00 grms.; carbonate of soda, pure and dry, 100·00 grms.; chloride ammonium, 6·87 grms. These salts are mixed with 500 to 600 grms. of distilled water, dissolved in the water-bath, and made up to 1 litre, filtering if needful. 10 c.c. of this liquid = 0·05 grm. of sugar.

Lactic Fermentation.—L. Boutroux.—The author considers the lactic ferment and the *Mycoderma aceti* as one and the same organism, its functions varying with the composition of the putrescent medium.

Researches on the Chemical Composition and the Functions of the Leaves of Plants.—B. Corenwinder.—The author maintains that young leaves inspire oxygen and exhale carbonic acid, but as they reach maturity this diurnal expiration of carbonic acid ceases. This change is accompanied by a decrease in the relative amount of nitrogenous matter and of the phosphorus, which become less in quantity as the leaves grow older, whilst the lime increases. The function of the chlorophyll is to retain and decompose the carbonic acid given off in respiration.

Mineral Waters of Challes in Savoy.—E. Willm.—The springs in question are very rich in iodine and sulphur.

MEETINGS FOR THE WEEK.

Monday, April 8th.—Medical, 8.30.
—— London Institution, 5.
—— Royal Geographical, 8.30.
—— Society of Arts, 8. (Cantor Lectures). "Some Researches on Putrefactive Changes, and their Results in Relation to the Preservation of Animal Substances," Dr. B. W. Richardson.
Tuesday 9th.—Civil Engineers, 8.
—— Royal Institution, 3. "Protoplasmic Theory of Life, and its Bearing on Physiology," Professor Garrod.
—— Photographic, 8.
—— Anthropological, 8.
Wednesday, 3rd.—Society of Arts, 8. "A New Method for Producing Cheap Heating Gas for Domestic and Manufacturing Purposes," Mr. S. W. Davies.
Thursday, 11th.—Royal, 8.30.
—— Royal Institution, 3. "Chemistry of the Organic World," Prof. Dewar.
—— Royal Society Club, 6.30.
—— London Institution, 7.
—— Mathematical, 7.
Friday 12th.—Royal Institution, 8. Weekly Meeting. "The Distribution of Plants in North America," Sir Joseph D. Hooker, 9.
—— Astronomical, 8.
—— Quekett Club, 8.
Saturday, 6th.—Royal Institution, 3. "On the Clavecinists of England, Italy, France, and Germany, and their Works," with Musical Illustrations on the Harpsichord and Pianoforte, Prof. Pauer.
—— Physical, 3.

Mr. WATTS'S DICTIONARY OF CHEMISTRY.

Complete in 7 vols., medium 8vo., price £10 16s. 6d.

A DICTIONARY of CHEMISTRY, and the Allied Branches of other Sciences. By Henry Watts, F.R.S., assisted by eminent Scientific and Practical Chemist

"The greatest work which England has yet produced on chemistry—one of the greatest, indeed, which she has produced upon any scientific subject—is finished at last, and we are able to congratulate Mr. Watts most sincerely upon its completion."—*Chemical News.*

"The English language is not rich in lexicons of science: we would point to this work as a model upon which others might be framed. It certainly exhausts the subject up to the date of publication, and therefore forms as it were the balanced ledger of the chemist."—*Athenæum*

London: LONGMANS and CO.

Now ready, 8vo., cloth, 30s.

PHOTOGRAPHED SPECTRA. One Hundred and Thirty-six Photographs of Metallic, Gaseous, and other Spectra, printed by the permanent autotype process, with Introduction, Description of Plates, and Index; and with an extra plate of the Solar Spectrum (showing bright lines), compared with the Air Spectrum, by J. Rand Capron, F.R.A.S.

London: E. and F. N. SPON, 48, Charing Cross.
New York: 446, Broome Street.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

THE TELEPHONE.

Arrangements for Exhibiting or Fixing on application to EDWARD PATERSON, Telegraph Engineer, 3, Bedford Court, Covent Garden, W.C. Insulated Wires, Call-Bells, Insulators, and Galvanised Wire for Overhead Lines. Electric House-Bells, and all descriptions of Electrical Apparatus for experimental and other purposes. Price list post free 2 stamps.

THE NEW MINIATURE SPRENGEL PUMP.

(STEARN AND SWAN'S PATENT.)

As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

In 8vo., price 21s., Illustrated.

CHEMISTRY.

By H. E. ROSCOE, F.R.S.,
AND
C. SCHORLEMMER, F.R.S.,
Professors of Chemistry in Owens College, Manchester.

Vol. I. The Non-Metallic Elements. With numerous Illustrations and Portrait of Dalton. [*Vol. II. in the Press.*

"We are struck with the number and the excellence of the illustrations, which in clearness and minute accuracy may be considered unrivalled. These merits belong not merely to the figures representing apparatus as employed in the laboratory, but to those explanatory of manufacturing plant on a large scale. . . . It is not too much to say . . . that the work may claim a place along with, and complementary of, the great systematic productions of Watts and of Gmelin, with the additional recommendation of being brought down to the most recent state of the science . . . an important feature—is that the work recognises no gulf between theory and practice, and deals with the chemistry of the factory as well as with the more refined operations of the laboratory. How great a boon this must prove to the student, and ultimately to the manufacturer and the nation, does not require to be further shown."—*Chemical News.*

"It appears to us to be by far the most useful systematic work on chemistry which has appeared since the publication of Graham's 'Elements of Chemistry.' The clearness of its style, the fulness of its information, the judgment which its authors have used in the arrangement of their facts, no less than its general accuracy, entitle this beautiful volume to the first place among the English text-books on chemistry."—*Manchester Courier.*

London: MACMILLAN and CO.

YOUNG'S PARAFFIN LIGHT & MINERAL OIL CO.

LIMITED.

The Directors of this Company are prepared to receive TENDERS for the supply of the GENERAL STORES required at their Addiewell, Bathgate, and Lochrin Works, and also at all their Pits, for the year ending 30th April, 1879, as under:—

Class No.		Class No.	
1.	Bolts, Nuts, and Rivets.	21.	Hardware and Sundries.
2.	Bricks, Clay, &c.	22.	India-rubber, &c.
3.	Brushes and Mops.	23.	Lamp Burners, Stands, &c.
4.	Candle Boxes.	24.	Lamp Founts.
5.	Canvas.	25.	Lamps—Glass.
6.	Cast-Iron Castings.	26.	Leather.
7.	Chemical Apparatus.	27.	Nails, Screws, &c..
8.	Cloths, Plaiding, &c.	28.	Paper Shades and Holders.
9.	Colours.	29.	Ropes, &c.
10.	Corks.	30.	Shades, Moons, &c.
16.	Drysalteries.	31.	Shives.
17.	Gas and Water Fittings.	32.	Silvered Reflectors.
18.	Glass Chimneys.	33.	Spelter, Tin, and Lead.
19.	Grease, Soap, and Tallow.	34.	Tin Work.
20.	Gun Metal.	35.	Wicks—Candle and Lamp.

Detailed Specifications and Forms of Tender, and any other necessary information, may be obtained, on and after Tuesday, 2nd proximo, at the Company's Registered Office, 13, Dundas Street, Glasgow.

Patterns of the General Stores may thereafter be seen at the Company's Addiewell Works, near Westcalder; and Patterns of Lamp Fittings at their Lochrin Works, Edinburgh.

Tenders, endorsed "Tender for Stores," to be lodged with the undersigned, or or before Wednesday, 17th proximo.

The Directors do not bind themselves to accept the lowest or any offer.

JOHN FYFE, General Manager.

13, Dundas Street, Glasgow.
28th March, 1878.

GLASGOW CORPORATION GAS.

RESIDUAL PRODUCT WORKS TO LET, AND RESIDUAL PRODUCTS FOR SALE.

The Glasgow Corporation Gas Commissioners are prepared to receive Offers for a Lease of their Residual Product Works at Dawsholm, near Maryhill, and also for the purchase of the Tar and Ammoniacal Liquor produced at their Gas Works there. The Lease to be for such term of years, from 1st June, 1878, as may be agreed on. Offerers must offer a fixed Rent of £1200 per annum, and also a further sum in respect of each Ton of Coal carbonised at the Dawsholm Gas Works. On application at the Gas Office (Manager's Department), 42, Virginia Street, intending Offerers will receive Orders for inspecting the Works. The Conditions of Let and Sale may be seen, and Forms of Offer obtained on application to the Subscriber, and Offers will be received by him up till Monday, the 22nd current.

The Commissioners do not undertake to accept the highest or any Offer.

J. D. MARWICK,
Clerk to the Commissioners.

City Chambers, Glasgow, April 2, 1878.

THE
QUARTERLY JOURNAL OF SCIENCE.

Edited by WILLIAM CROOKES, F.R.S., &c

Now ready No. LVIII., *April*, 1878, price 5s.

CONTENTS.

I. Economy of Nitrogen.
II. On the Movements of Microscopic Particles Suspended in Liquids. By Prof. W. Stanley Jevons, LL.D., M.A., F.R.S.
III. Energy and Feeling: Alternate and Mutually Convertible Affections of Matter. By W. S. Duncan.
IV. The Gold and Placer Mines of Wicklow. By G. H. Kinahan, M.R.I.A., &c.
V. On the Relation of Moisture in Air to Health and Comfort. By Robt. Briggs, C.E.
VI. On Space of Four Dimensions, Illustrating the Phenomena ascribed to Spiritualism. By Prof J. C. Friedrich Zöllner, Leipzic. (With Page Lithograph.)
VII. Liquefaction of Oxygen. By M. Raoul Pictet. (Illustrated.)
VIII. The Phonograph. (Illustrated.)

Notices of Scientific Works, Scientific Notes, &c.

London: 3, Horse-Shoe Court, Ludgate Hill, E.C.

Chemical Technology, or Chemistry in its Applications to the Arts and Manufactures. By THOMAS RICHARDSON and HENRY WATTS. Second Edition, illustrated ith numerous Wood Engravings.

Vol. I., Parts 1 and 2, price 36s., with more than 400 Illustrations.

Nature and Properties of Fuel: Secondary Products obtained from Fuel: Production of Light: Secondary Products of the Gas Manufacture.

Vol. I., Part 3, price 33s., with more than 300 Illustrations.

Sulphur and its Compounds: Acidimetry: Chlorine and its Bleachin Compounds: Soda, Potash: Alkalimetry: Grease.

Vol. I., Part 4, price 21s., 300 Illustrations.

Aluminium and Sodium: Stannates, Tungstates, Chromates, and Silicates of Potash and Soda: Phosphorus, Borax: Nitre: Gun-Powder: Gun Cotton.

Vol. I., Part 5, price 36s.

Prussiate of Potash: Oxalic, Tartaric, and Citric Acids, and Appendices containing the latest information, and pecifications relating to the materials described in Parts 3 and 4.

BAILLIERE AND CO., 20, King William Street, Strand.

South London School of Pharmacy, 325, Kennington Road. Managing Director, DR. MUTER.
Daily Lectures on the following subjects:—

CHEMISTRY.	MATERIA MEDICA.
BOTANY.	PHARMACY.
PHYSICS.	CLASSICS.

The School has accommodation for 120 Students, and contains an excellent Museum and a very completely fitted Chemical Laboratory for 50 Junior and 20 Senior Pupils, with water and gas at everyworking bench.

For all particulars, enclose a stamped envelope to the Secretary, Mr. W. BAXTER, at his office, Central Public Laboratory, Kennington Cross, London, S.E.

MILTON CHEMICAL WORKS,
STOKE-ON-TRENT,
STAFFORDSHIRE.

JOSIAH HARDMAN is always prepared to supply, in large or small quantities, Anthracene, Benzol, Naphtha, Carbolic Acid, Creosote Oil, Pitch and Black Varnish, Sulphate of Ammonia, Sulphuric Acid (Rectified and Brown), made from Brimstone only. Paraffin Oil, Paraffin Wax, Torch Oil, Wagon Oil, Rope Oil, and all kinds of Oils and Greases used about Collieries, Iron Works, Brick Works, &c.

N.B.—J. H. heing a large manufacturer of the above can offer Specia Advantages to Shippers, Merchants and Consumers, &c.

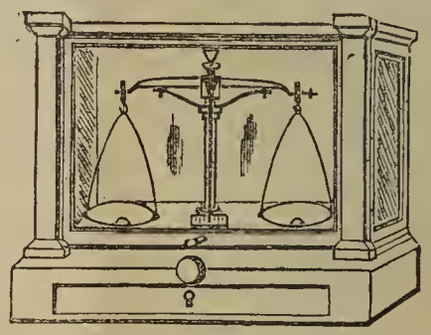
Address—JOSIAH HARDMAN, Chemical Works, Milton, Stoke on Trent

GEOLOGY.—In the Preface to the Student's ELEMENTS of GEOLOGY, by Sir Charles Lyall, price 9s., he says:—"As it is impossible to enable the reader to recognise rocks and minerals at sight by aid of verbal descriptions or figures, he will do well to obtain a well-arranged collection of specimens, such as may be procured from Mr. TENNANT (149, Strand), Teacher of Mineralogy at King's College, London." These Collections are supplied on the ollowing terms, in plain Mahogany Cabinets:—

100 Specimens, in Cabinet, with 3 Trays.. ..	£2	2 0
200 Specimens, in Cabinet, with 5 Trays.. ..	5	5 0
300 Specimens, in Cabinet, with 9 Drawers ..	10	10 0
400 Specimens, in Cabinet, with 13 Drawers ..	21	0 0

More extensive Collections at 50 to 5000 Guineas each.

BECKER & SONS,
MANUFACTURERS OF
CHEMICAL AND GOLD ASSAY BALANCES
AND OTHER
SCALES AND WEIGHTS.

ROTTERDAM.  NEW YORK.

BECKER'S STUDENT'S BALANCE, in polished mahogany glass case, sliding front, counterpoised, to carry 30 grammes in each pan and turn to ½ milligramme, nickel plated pans.. £2 10
Ditto, ditto, in mahogany glass case, polished black £2 13

Sole Agents for England, Ireland, and Wales:—
TOWNSON & MERCER,

Becker's Complete Lists forwarded by post on receipt of 1*d.* stamp, or free on application.

BISULPHIDE OF CARBON,
PROTOSULPHATE,
RED OXIDE
OXYCHLORIDE
Sulphocyanide,

And every other Mercurial Preparation.

BISULPHITE OF LIME, TETRACHLORIDE OF CARBON
Oxysulphuret of Antimony, Glacial Acetic Acid,

LIQUOR AMMONIÆ,
SULPHIDE OF IRON,
PURE ACIDS,
CHLORIDE OF SULPHUR,
ACETONE,
CHLOROFORM,
ALDEHYDE,
CHLORATE BARYTA,
ARSENIC ACIDS,
FRUIT ESSENCES FOR CONFECTIONERY & LIQUEURS,
PERCHLORIDE OF IRON,
SULPHITE AND HYPOSULPHITE OF SODA,
PHOSPHATES OF SODA AND AMMONIA,
ETHERS,
BROMIDES,
IODIDES,
SCALE AND GRANULAR PREPARATIONS.

ALSO,
Pure Photographic Chemicals of every kind.
MANUFACTURED BY
WILLIAM BAILEY & SON,
HORSELEY FIELDS CHEMICAL WORKS,
WOLVERHAMPTON

JAMES WOOLLEY, SONS, & CO.
69, MARKET STREET, MANCHESTER,
DEALERS IN
CHEMICAL AND SCIENTIFIC APPARATUS
CHEMICAL REAGENTS, &c.,
FOR THE USE OF
ANALYSTS, SCIENCE TEACHERS, AND MANUFACTURERS

Price Lists on application.

Sulpho-cyanide of Calcium, containing about 26 to 28, for Sale.—Address, Alpha, CHEMICAL NEWS Office Boy Court, Ludgate Hill, London, E.C.

THE CHEMICAL NEWS.

Vol. XXXVII. No. 959.

ON DYER'S CHEMICALS.

By J. MARZELL.

(Continued from p. 107.)

Picric Acid [$C_6H_2OH(NO_2)_3$].

The manufacture of picric acid from phenol is comparatively old, and intimately connected with the history of tar-distillation. The method stated by Laurent* in 1874 is still in use, in principle, and the only improvement in this way is the working up of the pure phenol.

Laurent made use of the whole tar. Later on only the fraction passing between 180° to 200° C. was taken, and now the purest market phenol is considered the only rational base for the picric acid manufacture (Crace-Calvert). A disagreeable point in working the pure acid was the very violent action of the nitric acid, and therefore the sulpho-compounds of the carbolic acid were taken as substitutes, either the free sulpho-acids,—

$$[P(SO_3H)x],$$

or their soda-salts, $[P(SO_3Na)x]$,† being brought into reaction with concentrated nitric acid.

Respecting the manufacture from the tar-oils, Quinon Ainé gives a report,‡ but in the present state of that industry it is of mere historical interest.

The picric acid has not been dislodged by the new dyes, and is still used in large quantities. Having a comparatively good market price its manufacture can lucratively be joined with the produce of pure carbolic acid, and therefore it might be of interest to describe in a few words the method of its manufacture.

Manufacturing Process.

As mentioned above, it consists in the reaction of concentrated nitric acid upon sulpho-compounds of phenol. To produce the sulpho-acids, equal parts of crystallised phenol and concentrated sulphuric acid of 1·843 sp. gr. are heated to about 100° C. till a sample taken out of the mass is completely soluble in water, hereby indicating the transferring of all the phenol into sulpho-compounds. Then the steam is shut off, and the whole allowed to cool down. In some works the sulpho-acids are now diluted in water, and therefore twice the quantity of water is added; a little steam supplied if needed. In other places it is preferred to take the concentrated acids directly into action. For forming the sulpho-acids: this operation either takes place in stone ballons standing in a steam-bath or in wooden tanks lined with lead, a system of steam-pipes lying on the bottom.

The action between the sulpho-compounds and the nitric acid is generally effected in stone ballons, similar to those used for the absorption of hydrochloric acid vapours in the soda works. The round cover is fastened air-tight during the reaction by means of any cement standing the acid. Of the two tubules one serves for carrying away the nitrous, &c., vapours, the other for supplying the sulpho-compounds. The ballons stand in a double line in a steam-bath. At a small distance above them two pipes run along, being joined with each pot by junctions. The one is the main-pipe for the nitrous, &c., vapours, and leads directly into the condensing apparatus; the other has to conduct the sulpho-acids. In the tubulus intended for this, a funnel is fastened air-tight, leading below the surface of the nitric acid in the pot. From the main pipe there are short pipes with cocks to each of these funnels, allowing the supply to be regulated as wanted. The concentrated nitric acid is put into the pot, and the sulpho-compounds are added slowly. It is of no advantage to hasten the operation, as in this case black resinous products are formed, with a considerable loss of the nitric acid, and causing great difficulty and annoyance in the purifying process.

The principal part of the reaction takes place without requiring any heat, and only at the end of the operation the steam is turned on, by which the action re-commences, and the last traces of unassailed crude products are oxidised. If there is not observed any further development of red nitrous vapours the steam is stopped, and the whole allowed to cool down.

I mentioned above that the sulpho-compounds are also taken without being diluted in water. In this case the reaction has to be moderated by stirring the mass whilst the operation goes on. The apparatus in use for this are analogous to those which have answered all demands in the nitrification of benzol, &c. They are cast-iron pots, with agitator driven by mechanical means, and different arrangements following the supply of the different materials, the carrying away of the arising vapours, and so on. Working in this way, the sulpho-compounds can be formed in the same pot, and then the nitric acid be supplied gradually into the concentrated mixture of $P(SO_3H)x$. The resulting picric acid forms an oily syrup-like mass, forming large and hard crystals in cooling. They are broken, isolated in a centrifugal machine or a filter, washed once or twice with cold water, and finally pressed. They are then diluted in boiling water, slightly acid (40 to 50 grms. of nitric acid per gallon of water generally taken), and allowed to crystallise.

Instead of that purifying by crystallising, it is often much preferred to convert the free acid into an alkali salt, to purify this, and to regain the pure and free acid by decomposing the same.

From the theoretical point of view the potassium salt would indisputably be preferred to the sodium salt. It is much more soluble than the latter, which, besides that, always takes into solution a part of the accompanying oily impurities. The worst difficulty—nearly insurmountable—in working on a large scale is the fact that the potassium salt, so very soluble in boiling water, separates as the liquor cools with an immense rapidity. That disagreeable quality causes much delay in the filtering process, as the precipitating crystals of picrate and potassium stop the pores of the filters and puts them out of work. By heating up the filters by means of indirect steam and different other expedients, trials were made to prevent that mischief, but none of them seemed to answer very well, and as the advantages are after all not so very great, the sodium salt is now adopted in nearly all works.

To convert the acid into soda salt, either the crystals are taken as they come out of the pots, or they are once re-crystallised out of acid water, as by this operation a part of the resinous by-products is already carried away. To get rid of all these impurities entirely, the soda is added in two portions. After having mixed the first part of the alkali to the hot solution of picric acid, it is filtered or digested from the impurities whilst hot. (The oily bodies are not yet diluted in the still acid liquid.) After this the rest of the soda is supplied to the filtrate. The alkali has to be taken in excess, as the picrate of soda is nearly insoluble in the alkaline solution, and therefore separates nearly theoretically.

The picrate of soda is gathered, pressed, washed with cold water, then diluted in boiling water, and oversaturated with sulphuric acid. The picric acid is precipitated, and precipitates nearly entirely, as it is insoluble in the mother-liquor containing the acid modification of sulphate of soda ($NaHSO_4$).

Many experiments have been made on purpose to replace

* *Ann. Chem. et de Phys.*, [3], iii., 221.

† "Rapports de la Jury, International, Paris, 1867," tome vii., Class 448, p. 280.

‡ *Mem. de la Soc. d'Agr. a Lyon*, 1849.

the alkalies by lime; but the results have not proved satisfactory:—

(1.) The basic lime salt formed—

$$C_6H_2(NO_2)_3O\diagdown Ca$$
$$C_6H_2(NO_2)_3O\diagup$$

is scarcely soluble. Of course that could be overcome by not saturating entirely, or by adding a certain quantity of free picric acid in filtering.

(2.) The sulphuric acid cannot be taken any more for decomposition, as the sulphate of soda ($CaSO_4$) formed would precipitate and mix with the settling picric acid, which would again be in contact with the impure mother-liquors. This point is the greatest difficulty. Only nitric and hydrochloric acid, therefore, could be taken in view of their forming salts soluble in water. But both these acids take not by any means unimportant quantities of picric acid into solution, rendering so illusory all advantage which was expected of the difference in price between the crude materials. Concentrated sulphuric acid of 1·843 sp. gr. also keeps a small quantity diluted; but by adding 2 to 3 volumes of water the picric acid is precipitated entirely. Weak H_2SO_4 (proportion 1 : 11) does not dilute any picric acid.

For recognising picric acid the following comparing reactions may be of use (L. Kopp):—

With NaOH, colours yellower.
With $SnCl_2$, in boiling, slight yellowish precipitate.
With Fe_2Cl_6, golden-yellow precipitate.
With NaSH, yellowish red; boiling, dark reddish yellow; concentrated, blood-red.
With Am_2S, like with NaSH.
With $CaOCl_2$, sometimes white, turbid.
With KCN, yellow-red; concentrated, blood-red.

Examination.

With the picric acid of commerce very often impurities are mixed, proceeding either from the process or added purposely as adulteration. They can easily be found out by taking advantage of the difference in qualities between them and the picric acid.

(1.) *Resinous Substances.*—They generally come from the picric acid process, but nevertheless they very seldom amount to more than 0·03 to 0·05 per cent; they are only noxious in the dyeing-bath. To separate them, 5 grms. of picric acid are diluted in hot water, a drop of sulphuric acid is added, and filtered. The resinous and oily impurities remain in the filter.

(2.) *Oxalic Acid.*—It is very possible that small quantities of this arise from the process, as that body is easily formed if the reaction of nitric acid is too violent or goes too far; and, as well, it can crystallise out with the picric acid and can escape an even very carefully conducted purifying. But if there are larger quantities found, an intentional adulteration can be concluded. The sample is diluted in hot water, some ammonia and a few drops of a solution of $CaCl_2$ are added. The formed oxalate of lime,—

$$COO\diagdown Ca,$$
$$COO\diagup$$

is gathered on a filter, dried at 100° C., and weighed. 100 parts of oxalate of lime will answer to 69·7 parts of pure oxalic acid.

(3.) *Saltpetre.*—Can arise from the process, especially if the water used for re-crystallisation was acidified with nitric acid instead of sulphuric acid; but generally it is put in purposely. It can easily be separated, as it is not at all soluble in strong alcohol. 5 grms. of picric acid are digested with about 50 grms. of absolute alcohol. The residue is gathered on a filter, and washed with alcohol till the filtrate is absolutely colourless. The residue on the filter is dried at 100° C., and weighed. To examine it properly for NO_3Na an analysis would be wanted, but generally it is enough to know the quantity of impurities, and never mind their theoretical composition. A special test for saltpetre or nitric salts in general is when the body in question, put upon red-hot coals, detonates, of which fact advantage can easily be taken here.

(4.) *Sulphate of Soda.*—It is detected in the same way as the foregoing. An approximate test upon H_2SO_4 can be made in adding a solution of hydrochlorate or nitrate of baryta, which causes a precipitate.

(5.) *Sugar.*—The sample is diluted in boiling water, saturated with carbonate of potassium, evaporated to dryness on the water-bath, and the sugar extracted from the residue by means of alcohol. The usual method of sugar testing is of not much use here, as the picric acid itself is altered by reducing agents. To separate the picric acid from the whole lot of impurities, and to see the percentage of the pure body easily, J. Casthelaz* constructed an apparatus, which he calls Picrometer. The sample is put into a graduated cylinder and shaken with ether, which only dissolves out the picric acid, so that the remaining impurities can easily be made out. M. Moyret† proposes to take benzol instead of ether, which is generally accepted now. But in this case it is good to hold the cylinder in warm water, as the benzol does not dilute the picric acid so very easily.

ON

SOME SIMPLE LABORATORY MANIPULATIONS.

By Dr. P. TOWNSEND AUSTEN, F.C.S.,
Assistant Professor of Chemistry in Rutger's College.

THIRD PAPER.

As I see in the CHEMICAL NEWS (vol. xxxvi., p. 57) some allusions made to various forms of wash-bottles, I should like to mention how extremely useful I find a series of different sized jets. It would appear so self-evident that one would think everyone who used a wash-bottle would have a set; yet, indeed, I have known chemists to have a whole series of wash-bottles in order to throw different sized jets. These jets I keep in a division of a drawer. They can be changed in a moment.

Jets are best made by allowing the heated glass to close, until the right size of aperture is obtained. Drawing a tube is not to be recommended, since the stream of water it delivers is rarely round, and hence likely to spray. Moreover, such jets, when made fine, are extremely fragile.

A useful form of jet, and one that I have never seen, although I suppose the idea must have occurred to several, is made in the following manner:—Close the end of a glass tube of about 4 m.m. internal diameter and about 1 m.m. thickness, and blow a bulb about 1 c.m. in diameter. Then heat a platinum wire to a white heat in the flame of a blast-lamp. The flame should be about 5 c.m. long, and the heated spot about 1 c.m. from the end of the wire. By gently pressing the side of the bulb against the wire it is easily pierced. On withdrawing the wire slowly, and at the same time allowing it to cool very slightly (which is effected by holding it higher up in the flame), a small round hole is made in the side of the bulb. The size of the hole depends on the diameter of the wire, its temperature, and the rapidity with which it is withdrawn. The sharp edges are easily removed by carefully filing with a fine file moistened with caustic soda solution.

This form of jet has the advantage that it throws a powerful stream at right angles to the delivery-tube. I find it extremely useful in washing many precipitates, and particularly in dislodging particles adhering to the sides of a filter. It is also useful in washing down precipitates from inverted vessels. Its shape renders it very strong, there being no projecting points to break off.

A bulb-jet with three small holes, in the form of a tri-

* *Moniteur Scientifique*, 1866, 984.
† *Ibi* 1866, 1036.

angle in the bottom, will be found remarkably efficacious in washing down precipitates from deep inverted beakers, large test-tubes, &c. The streams must not diverge more than 1 c.m. at a distance of 30 c.m.

I have lately made my ordinary jets in this manner—having, however, only one hole in the bottom—since they are so much stronger. By holding the jet up for an instant after cessation of the blast, the liquid in the delivery-tube will run back into the flask, thus preventing the annoying dribble which accompanies a wash-bottle with a drawn jet.

For washing large amounts of substances, not intended for quantitative operations, I use a bulb-jet having a fine hole in the bottom, and four others, equidistant from each other, in the periphery of the bulb.* This jet I thrust deep down in the filter, and blow a strong blast of water until the liquid reaches the desired height.

Filter-Papers without Ash.

For many purposes such papers are extremely useful. There is nothing new I believe in the use of hydrofluoric acid for this purpose, but perhaps the following may be useful as a laboratory recipe:—

Ordinary white German filter-paper is cut in the desired form, and washed out with hydrochloric acid as usual. 30 c.c. of strong hydrochloric acid and 15 c.c. of commercial hydrofluoric acid are mixed together in a platinum dish, and diluted with water to 500 c.c. The papers are placed in the liquid, and allowed to remain for four or five days. The liquid is then poured off, and the filters washed with hot water. This is best done by pouring hot water on them, allowing it to remain about ten minutes, and then decanting. This is repeated until the washings have no longer an acid reaction. The papers are then placed in a porcelain dish, and washed with warm water until no hydrochloric acid can be detected in the washings; after which they are dried in an air-bath. Paper prepared in this manner gives no appreciable ash on incineration.

Infusorial Earth for Drying.

I may be pardoned for drawing attention to this remarkable absorbent. It has been used in technical operations in Germany, I believe, for several years, and now is gradually finding an introduction into the laboratories.

A wet filter-paper placed on a thin layer of it (5 to 10 m.m. thick) becomes only damp, in fact almost dry, in an incredibly short space of time. It far surpasses, in my opinion, porous plates and plaster of Paris slabs. It has also the advantage that by heating it becomes again ready for use. Manufacturers of the article claim that it absorbs six times its weight of water.

In cases where the substance and filter-paper are to be weighed it is only necessary to place the wet paper, with the substance on it, on a paper (or two) of somewhat greater diameter (10 c.m. greater diameter). This prevents any danger of the earth getting on to the first paper. Those precipitates which Bunsen burns on the wire while still damp, are ready for incineration after five or six minutes on the earth.

This remarkable absorptive power makes an excellent lecture illustration. Two filter-papers are dipped in water and exhibited. One is then placed in a thick layer of the earth, and firmly pressed. The adherent earth is then scraped from the paper by a stroke with a table-knife. The two papers are now shown side by side, and make a striking contrast.

New Pyrogenous Derivative of Tartaric Acid.—M. E. Bourgoin.—The product obtained, dipyrotartaric acetone, is a neutral body, very sparingly soluble in water, but soluble in alcohol, ether, sulphide of carbon and chloroform. Its odour is aromatic, and not unpleasant, and its specific gravity borders closely upon that of water.—*Comptes Rendus*, lxxxvi., No. 10.

* A bulb of this kind is also useful in delivering gases which are to be washed.

ON THE LOSS OF NITRE IN THE MANUFACTURE OF SULPHURIC ACID.

By EDWARD JACKSON.

In a recent number of the Chemical News, Mr. G. E. Davis gives an account of some interesting experiments he has made to determine the source of loss of nitre in the manufacture of sulphuric acid. May I ask Mr. Davis if he has made any attempts to ascertain if the quantity of nitrous acids in the outlets corresponds with the loss as determined by the oxidation of the As_2O_3 to As_2O_5?

About six or seven months ago I devised a method of estimating these nitrous acids in the outlets, which has been in daily use here ever since. The process I use for collecting the gases is that proposed by Mr. Mactear for collecting the sulphurous acids. The gases are drawn first through a series of tubes containing caustic potash, and then through another series of tubes containing permanganate, the latter made slightly acid with HCl.; indeed, I have tried the latter with and without the acid, and the result is practically the same. The rate at which the gases are drawn through the liquids is about one cubic foot every four hours. Each morning the tubes are collected, the caustic and permanganate solutions mixed, made very slightly acid with HCl, and boiled to decompose the permanganates. Should the solution smell of chlorine—this rarely happens, except when too much acid has been used—it is boiled until all smell of that gas disappears. It is now filtered, made up to a definite volume, and an aliquot part taken for determining the nitrates; the remaining portion is used for determing the sulphates. The method used for estimating the nitrates is that recommended by Dr. Lunge (Chemical News, vol. xxxvi., page 145). A few grains of fine piano-forte wire are dissolved in a small flask, fitted with a Bunsen's valve, sulphuric acid being used to effect solution. The nitrate solution is next added, and boiled to expel the N_2O_2, the unoxidised iron being determined by permanganate. The number of cubic feet of gases passing through the outlets is ascertained from the percentage of oxygen found in the residual gases, as proposed by Mr. Mactear (Chemical News, vol. xxxvi., p. 49.) By a simple arrangement, an average sample of the gases from the chambers is used for determining the percentage of oxygen.

Now, from the experiments conducted as above described, I am satisfied that while the oxidation of the arsenic may account for a portion of the loss, it will not account for the whole. Of course I do not expect to find in the outlets as much nitre, in the form of nitrous acids, as is used in the furnaces, but the difference between that found and that used is too great to be accounted for by waste, such as blowing out from the chambers, the small quantity which is run into the salt cake pans, &c.

During the whole of the time this testing for nitre has been going on, about 40 lbs. of nitre to the ton of stone have been used. The average quantity found in the outlets does not exceed one-third of that amount; nor is the quantity found regular. Thus, during the past week, the average quantity found does not exceed 4 lbs. per ton of stone, while, about a month ago the quantity found during one week exceeded the quantity used for that week. It is true the quantity used had to be slightly increased the next week, as the chambers were getting short of nitre, and the condensation of sulphurous acid was not so perfect.

We see, then, that the oxidation of the As_2O_3 to As_2O_5 does not account for the whole loss of the nitre. I have an idea in what direction to look for the difference, and have already performed some experiments with the subject of finding it, but as yet have not been successful. I shall follow up the subject as opportunity offers, and should I meet with success will communicate the result to the Chemical News.

Messrs. T. Adkins & Co. Laboratory
Smethwick, near Birmingham.

TABLE SHOWING THE BEHAVIOUR OF CERTAIN MINERALS WITH CITRIC ACID, ALONE AND WITH REAGENTS.

In the Cold.			Decomposed (in Fine Powder) by a Solution of Citric Acid.			On Boiling.					
A. Without Evolution of Gas.	B. With Liberation of CO_2.	C. With Liberation of H_2S.	D. Without Evolution of Gas.	E. With Liberation of CO_2.	F. With liberation of H_2S.	G. With formation of a jelly, (SiO_2).	H. With Separation of SiO_2.	I. Decomposed by boiling with $C+KNO_3$.	K. Decomposed by heating with $C+NH_4Fl$.
Brucite	Calcite	Stibnite	Zincite	Magnesite	Bornite	Willemite	Wollastonite	Argentite	Olivine
Angelsite	Dolomite*	Galenite	Gypsum*	Siderite	Bournonite*	Datolite	Chrysolite	Chalcocite	Wernerite
Pyromorphite*	Ankerite*	Sphalerite	Apatite*	Pyrolusite†		Pectolite	Chondrodite*	Pyrite	Orthoclase
Vivianite	Gurnite	Pyrrhotite	Cuprite	Wad†		Calamine	Chrysocolla	Marcasite	Albite
	Rhodochrosite*		Limonite*	Hausmannite†		Natrolite	Prehnite*	Nicolite	Labradorite
	Smithsonite*			Manganite†			Apophyllite*	Smaltite	Augite
	Witherite			Psilomelane†			Rhodonite	Chalcopyrite	Diopside
	Strontianite						Analcite	Ullmannite	Hornblende
	Barytocalcite						Chabacite.	Arsenopyrite	Kyanite
	Cerussite						Stilbite	Tetrahedrite	Talc*
	Malachite						Serpentine	Uraninite	Spodumene*
	Azurite*						Chrysotile*		Almandite
			And those in A.	And those in B.	And those in C.		Retinalite		Epidote
							Deweylite	And those in F and C.	And those in G and H.

L. *Minerals not decomposed by the above reagents* :—Molybdenite, cinnabar; magnetite, hematite, chromite, franklinite; cryolite, fluorite; samarskite; muscovite, biotite, ripidolite, and tourmaline.

* Feebly attacked.

† The CO_2 evolved is derived from the citric acid.

N.B.—The gases evolved are examined with acetate of lead test-paper; the solutions with appropriate reagents.

APPLICATION OF ORGANIC ACIDS TO THE EXAMINATION OF MINERALS.*

By H. CARRINGTON BOLTON, Ph.D.

(Concluded from p. 99).

Decomposition of Silicates by Organic Acids and Ammonium Fluoride.

21. A hot concentrated solution of citric acid decomposes ammonium fluoride, setting hydrofluoric acid free; and if silicates are present, many of them dissolve with great facility. Those minerals which were hardly attacked by citric acid alone, viz.: olivine, wernerite, chondrodite, and prehnite, together with the following not previously examined, orthoclase, albite, labradorite, augite, diopside, hornblende, almandite, spodumene, kyanite, talc, and epidote, are more or less readily decomposed. Of the latter, albite, labradorite, and augite, dissolve quite freely, while epidote appears to be slightly attacked by citric acid alone.

That this method of attack must be conducted in platinum vessels, goes without saying; the silicon evolved as a fluoride may be detected by suspending a moistened glass rod in the vapours, causing a gelatinous precipitate. To obtain affirmative results, it is essential that the silicates should be in very fine powder; the common micas, muscovite and biotite, which are obtained in pulverulent form with great difficulty, appear to resist these reagents; and ripidolite is but slightly attacked, perhaps for the same reason.

Tourmaline decidedly resists the action of these reagents, as well as the fluorides, cryolite, and fluorite. Samarskite is not attacked.

It is hardly to be expected that this method of examining minerals will be serviceable in field work, but it may prove applicable to quantitative analysis.

Summary of Results.

22. The results of this investigation establish the hitherto unrecorded fact that organic acids not only decompose a considerable number of minerals belonging to various groups, but they also possess a remarkable selective power as regards the degree of this decomposition; to make this selective property of citric acid evident, and at the same time to present a condensed recapitulation of its action on the ninety minerals examined, we have drawn up the annexed table. This table shows that citric acid alone divides minerals into eight groups: A, those which dissolve in the cold without evolution of gas; B, those which dissolve in the cold with liberation of carbonic anhydride; C, those which are decomposed in the cold with liberation of sulphureted hydrogen; D, those which dissolve in the hot acid without evolution of gas; E, those which dissolve in the hot acid with liberation of carbonic anhydride; F, those which dissolve in the boiling acid with liberation of sulphuretted hydrogen; G, those which are decomposed on boiling, with formation of gelatinous silica; H, those which are decomposed on boiling, with separation of silica in a slimy or a pulverulent form. To these eight groups we may add three more; I, those which are decomposed by boiling with citric acid and potassium nitrate; K, those which are decomposed by heating with citric acid and ammonium fluoride; and L, those which are not attacked by any of the preceding methods.

Under E fall five minerals, hausmannite, manganite, psilomelane, pyrolusite, and wad, which dissolve rapidly in hot citric acid and decompose it with liberation of carbonic anhydride. Advantage is taken of this reaction in the quantitative analysis of manganese dioxides.

Notwithstanding the sharpness of the reactions by which many of the minerals are characterised, we do not regard the annexed table as a scheme for their determina-

* Read before the New York Academy of Sciences, April 30 1877.

tion, but merely as a general view of their behaviour. The special cases in which minerals may be distinguished have been mentioned previously.

Under L are found thirteen of the ninety minerals examined; perhaps some of these will yield to these methods of attack by varying slightly the means of application. It is possible also that some of them may be decomposed by heating with citric acid solution in sealed tubes under pressure; but this process of course is not applicable to field work.

23. The applications of the methods of examining minerals detailed in the preceding pages are, we believe, numerous and important. Many of the reactions are simple, quickly applied, characteristic, and sensitive; they may be used, as we have seen, in distinguishing minerals nearly related, and probably in separating minerals mingled in one specimen. The methods will in all probability find useful application in quantitative analysis, a point which we propose to test at some future time. We have already employed a solution of citric acid in the analysis of limestones, for the determination of carbonic anhydride by loss. The evolution of gas proceeds regularly and the limestone is completely decomposed; citric acid possesses an advantage over hydrochloric acid in being non-volatile. Experiments to test the accuracy of the method were made with well-dried precipitated carbonate of calcium, and gave results differing by two or three tenths from the theoretical percentage.

By using the non-volatile organic acids in microscopic work whenever applicable, possible injury to the metallic mountings may be avoided, and in certain cases characteristic phenomena may be observed.

The importance of the application of these methods to the examination of minerals and rocks *in the field* is evident. The testimony of various persons as to the practicability of blowpipe work and chemical work in the field differs greatly, some claiming that it is valuable and easily accomplished, and others that it is altogether impracticable. Professor Geikie, Director of the Geological Survey of Scotland, mentions as a valuable addition to the geologist's outfit, "a small bottle of weak hydrochloric acid, carried in a protecting wooden box or case, of use for testing carbonates;" and he quotes Sir William Logan as employing acid to test the material adhering to a "limestone spear," with which the underlying strata can be probed.*

We propose, therefore, the substitution of a stout pasteboard box, containing solid citric (or tartaric) acid, for the usual glass bottle of liquid hydrochloric acid, and the addition of potassium nitrite to the usual list of dry reagents contained in portable blowpipe cases. Since citric acid solution decomposes potassium nitrite in the cold, we can carry nitric acid practically in a solid form; hydropotassium sulphate, already in use, furnishes sulphuric acid in a solid state; and it only remains, therefore, to provide for hydrochloric acid. Our experiments have as yet failed to solve this problem directly; ammonium, sodium, and potassium chlorides appear to resist the action of the organic acids. Iodine, on the other hand, while much less powerful than chlorine, possesses similar properties, and will form a valuable addition to the list of dry reagents; in aqueous solution it attacks many sulphides, and gives rise to characteristic phenomena. Iodine water was employed as early as 1858, by Professor Henry Wurtz, to separate pyrrhotite from pyrite;† but he did not extend its use to the determination of minerals, a question which we are now engaged in studying, and which has already yielded very interesting results.

Citric acid, potassium nitrite, and iodine, then, added to the reagents in common use,—borax, sodium carbonate, potassium cyanide, ammonio-sodium phosphate, test-lead, tin, and an assortment of test-papers, including acetate of lead paper, together with as many of the solid reagents used in solutions as space will admit, would complete the outfit of *dry reagents* for *wet analysis* and for blowpiping.

A pocket case, made of lacquered tin, 20 c.m. long, 5 c.m. wide, and 2·3 c.m. deep, containing pasteboard boxes (pill-boxes) of citric acid, potassium nitrate, dried borax, and sodium carbonate, together with a few simple requisites for blowpipe work, has been used by the writer in short mineralogical excursions with great satisfaction. To carry on the examination with solutions, we are also provided with a pasteboard case, cylindrical in form, 14 c.m. long, containing five stout test-tubes, fitting one within another, like a nest of beakers; the interior tube is open at both ends, a cork inserted tightly in the centre of the tube divides it into two compartments, one of which is filled with pulverised citric acid and the other with potassium nitrite, to be subsequently dissolved in water obtained in the field. This simple arrangement, greatly economising space, will naturally suggest itself to all working mineralogists, and would scarcely be worth mentioning were not wet analysis commonly regarded as impracticable in field work.

In proposing the use of organic acids in this connection, we are aware that they already occupy a place in the lists of "Special Reagents" contained in the larger treatises on Blowpipe Analysis. Plattner* mentions tartaric acid, but limits its use to the separation of yttria and zirconia (by ammonium sulphide); and he names oxalic acid as employed in the precipitation of lime and in the separation of iron and uranium from yttrium, cerium, and lanthanum. To remove the organic acids from this restricted use, and to accord to them a more important position in the list of reagents, is our aim.

Application to Geological Phenomena.

24. This newly developed power of the organic acids has undoubtedly an important bearing on the chemistry of geological changes: organic acids, resulting from the decomposition of vegetable and animal matter, demand recognition as powerful agents in the work of disintegration and consolidation.

Many of the results attributed to the imperfectly studied bodies, geic acid, $C_{20}H_{12}O_7$, humic acid, $C_{20}H_{12}O_6$, and ulmic acid, $C_{20}H_{14}O_6$†—as well at the oxidation products, crenic and appocrenic acids—are perhaps the silent work of a higher class of organic acids.

That such acids constitute ingredients of the soil is well established: "When the leaves of beets, tobacco, and other large-leaved plants, fall upon the soil, oxalic and malic acids may pass into it in considerable quantity. Falling fruits may give it citric, malic, and tartaric acids." "Formic, propionic, acetic, and butyric acids, or rather their salts, have been detected by Jongbloed and others in garden-earth. The latter are common products of fermentation, a process that goes on in the juices of plants that have become a part of the soil or of a compost."‡

How far these organic bodies assist in disintegrating rock material is largely a matter of conjecture; that they do exert considerable influence may be concluded from the existence in the soil of the ulmates, humates, apocrenates, and crenates of potash, soda, ammonia, lime, magnesia, iron, manganese, and alumina. We have, moreover, numerous instances of minerals containing organic acids in combination:

Berzelius and other chemists have remarked the occurrence in marshes of compounds of iron and organic acids, of undetermined composition. Prof. T. Sterry Hunt§ describes limonites containing from 12·5 to 15 per cent of humic acids; Dr. George A. Koenig,‖ in an

* Science Lectures at South Kensington: Outlines of Field Geology. 1877.

† *American Journal o Science*, (2), xxiv., 190.

* "Plattner's Manual," translated by Prof. H. B. Cornwall, third edition, pp. 53 and 54. 1875.

† Mulder, *Ann. Chem. Pharm.*, xxxvi., 243, 1840. Detmer ascribes to humic acid the formula $C_{80}H_{54}O_{27}$, and regards humic and ulmic acid as identical in composition. "Cf. Watts' Dict.," II. Suppl., 648.

‡ Prof. S. W. Johnson in "How Crops Feed." New York. 1870.

§ Geol. Canada, 1863, 510.

‖ *Proc. Acad. Nat. Sci.*, Philadelphia. 1876, p. 155.

investigation of the cause of the deep green colouration of amazon-stone from Pike's Peak, concludes that the colouring matter consists of some compound of iron with an organic acid, the nature of which he has not yet determined. Dr. Gideon E. Moore, in a paper on Cryptocallite, recently presented to the New York Academy of Sciences, refers to moresnetite containing iron combined with some organic acid. Forster* conjectures that the colour of smoky quartz is due to the presence of an organic substance containing carbon and nitrogen.

To these scattered notices may be added the small number of minerals, mentioned in Dana's "System of Mineralogy," of which organic acids form constituents:

Whewellite, calcium oxalate, occurring in small crystals on calcite.

Thierschite, another calcium oxalate, forming an opaline incrustation on the marble of the Parthenon at Athens. Its origin is attributed to the action of vegetation on marble.

Humboldtine, hydrous ferrous oxalate, forming an incrustation on brown coal.

Succinite, or amber, containing 2½ to 6 per cent succinic acid.

Mellite, or hydrous mellitate of alumina, containing 40 per cent of the organic acid.

Pigotite, a salt of alumina and mudescous acid (Johnston). Formed on granite by the action of wet vegetation.

To these belong also the peculiar minerals grouped by Dana under the name Acid Hydrocarbons, found in peat-bogs and in brown coal, and containing the ill-defined bodies, geoceric, georetinic, and butyro-limnodic acids.

25. The manner in which silicates are decomposed and silica rendered soluble for the use of the vegetable world has been a subject of much investigation. Friedel and Crafts,† in their remarkable researches on the ethers of silicic acid, and Friedel and Ladenburg,‡ in a paper on silico-propionic acid, have given a new insight into the functions of silica and its transformations in the organic kingdom. The reading of the latter paper before the French Academy of Sciences, June 27, 1870, excited a lively interest; the authors describe silico-propionic acid, $SiC_2H_5O_2H$, as a white amorphous body closely resembling silica, insoluble in water, and soluble in hot concentrated potassium hydrate. This communication drew from M. Paul Thénard§ a remarkable announcement with respect to the solvent power of nitro-humic acid‖ on silica; he stated in substance that the dark-coloured acids of the soil consist of a mixture of acids of the humic and nitro-humic series, which contain a notable amount of silica, the amount varying from 7·5 to 24 per cent; and he conjectures that acids of the "nitro-humic series form spontaneously in the soil at the expense of the humic acid, the ammonia of rain-water, nitrogen of the air, and of the silica pre-existing in the soil."

Dr. J. S. Newberry, in a private communication to the writer, describes the peculiar manner in which quartz pebbles found at Keyport, N.J., in a clay very rich in carbonaceous matters, are eroded. All the sharp angles on these pebbles have been rounded, and the surfaces are more or less deeply pitted, as if by some solvent. He has also observed other phenomena of similar character, which he conjectures should be ascribed to the action of organic acids.

These references would be incomplete without mention of the generalisations of Prof. Henry Wurtz, whose "Scheme of the Geogonic Migrations of Silica throughout the Kingdoms of Life,"* shows thoughtful study and novel views.

Taken as a whole, the information respecting the part played by organic acids in the changes taking place on the earth's surface, is but small: are we not justified in the belief that some of the reactions disclosed by our researches may in the hands of chemical geologists furnish material for generalisations of no small value?

Finally, we are conscious of having treated but a very small number of minerals, compared with those which remain to be studied; our aim has been to place the methods of examination on record, rather than to exhaust the resources of mineralogy.

We take pleasure in acknowledging the services of Mr. Edward W. Martin, a student in the Chemical Course at the School of Mines, who has kindly assisted us in a portion of these researches.

School of Mines, Columbia College, New York.

* *Pogg., Ann.*, cxliii., 173.
† *Bull. Soc. Chim.*, v., 174, 238 (1863).
‡ *Comptes Rendus*, lxx., 1407.
§ *Comptes Rendus*, lxx., 1412.
‖ In translating "*acide azhumique*" by the term "nitro-humic acid," we follow custom, but we are of the opinion that "azo-humic acid" would be more correct, since the word "nitro-humic" implies the existence of a "nitro" radical, NO_2.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, April 4, 1878.

Dr. J. H. Gladstone, F.R.S., President, in the Chair.

After the announcement of visitors, &c., the minutes of the last ordinary meeting and of the anniversary meeting were read and confirmed. The following certificates were read for the first time:—B. Gregory, A. E. Tucker, and T. Slinger. The under-mentioned gentlemen were balloted for and declared duly elected:—R. H. C. Nevile, R. H. Jude, T. H. Norton, A. K. Huntington, G. H. Rutter, S. S. O. Norris, J. Spencer, T. W. Drinkwater, A. N. Pearson, W. J. Macadam, W. A. H. Naylor, J. Tchermiac, M. Zingler, S. A. Goldschmidt.

Mr. H. C. Sorby, F.R.S., then delivered a lecture "*On the Application of the Microscope to some Special Branches of Chemistry.*" The lecturer stated that he felt himself placed in a difficult position; if he gave a full account of his subject he feared that every one would be wearied; if, on the other hand, he contented himself with a summary, he was afraid that he would not be understood. He did not propose to touch on the general use of the microscope for magnifying small crystals or examining the minute structure of larger ones, but to confine himself to an application of the microscope to certain branches of chemistry in which it had not hitherto been employed. He would therefore give a rough general sketch of this application, and dilate on subjects which were especially interesting to chemists. Lines and circles have long been looked at through doubly refracting media, such as Iceland spar, but, until lately, no one seems to have systematically studied the appearances which present themselves when appropriate objects are observed with a *microscope* through various crystalline substances. These appearances are quite different, because the object glass of the microscope collects the diverging rays, and we have new conditions. Dr. Royston Pigott described in 1876 (*Proceedings of the Royal Society*, xxiv., 393, and *Monthly Microscopical Journal*, xvi., 294) his refractometer. The principle made use of in this instrument was the increase of the focal length of the object glass of a microscope caused by looking through media of different refracting power. Dr. Royston Pigott measured this displacement by means of a micrometer screw, fixed under the stage in such a manner that it became unsuitable for its ordinary use. The author has succeeded in contriving an arrangement which, while it gives sufficient accuracy of measurement, allows the microscope to be used for general purposes.

* *American Chemist*, I 206.

Practically the application of this method is very simple. If an object be placed on the stage of a microscope and the focus adjusted accurately, on placing over the object a plate of some highly refracting substance the object will be invisible, and to bring it into focus the body of the microscope must be moved farther out. If this distance be "d" and the thickness of the plate be T, Royston Pigott has shewn that—

$$\mu, \text{ the index of refraction, } = \frac{T}{T-d}.$$

Now this distance can be measured either by means of a scale and vernier attached to the body of the microscope, or by having the head of the screw which works the fine adjustment graduated. To take an example, suppose we wish to determine the refractive index of water. A small piece of barometer tube is firmly cemented to a glass slide, and the cell thus formed filled with water; the cell is then covered with a cover-glass, which must be larger than the tube, and its surface must be parallel with that of the glass slide. Suppose the apparent thickness of water, t (*i.e.*, $T-a$) = 0·2360 inch, whilst d=0·0790 inch, then—

$$u = \frac{0{\cdot}2360+0{\cdot}079}{0{\cdot}2360} = 1{\cdot}335.$$

A second determination gave 1·334. In order to determine T and d we proceed as follows:—First, to get T we focus to the upper surface (any dust or scratches will do for focussing) of the glass slide, and read off the position of the body of the microscope; then focus to the under surface of the cover-glass and read off. The difference between these two readings evidently gives us the thickness of the stratum of liquid, *i.e.*, T. Secondly, to obtain d the image of a grating or circle is formed under the cell by means of a condenser under the stage, and the microscope focussed to it. The cover-glass, cell, and slide are now placed on the stage so that the observer looks through the cover-glass and slide but not through the cell. The image is again focussed; the difference between this reading and the first gives the displacement due to the slide and cover-glass. The cell is now pushed over the image, and the latter focussed; the difference between this reading and the second gives the displacement due to the stratum of liquid, *i.e.*, d. A two-thirds inch objective and No. 2 eye-piece are usually employed. To obtain accurate measurements many precautions are necessary, but with care T and d can be determined to 1-1000th of an inch. Red light is employed. For small quantities of liquid the ordinary live box is most convenient. The author has determined the refractive index of water with a film 1-50th of an inch in thickness and obtained the number 1·338. In a similar way the refractive indices of solids can be determined, the only condition being that suitable slices be cut, which are transparent more or less, and whose surfaces are flat and parallel. If we look at the image of a grating, *i.e.*, two systems of lines at right angles to each other, through a plate, with flat parallel surfaces, of glass or any transparent mineral which has no double refraction, both systems of lines are seen at once. The image thus formed is said to be *unifocal*, and the index of refraction thus determined is that of an ordinary ray. If, however, the mineral possesses double refraction the phenomena presented may be totally different; the ordinary ray has the same properties and is strictly unifocal; but the characters of the extraordinary ray differ according as the section is cut perpendicular, oblique, or parallel to the principal axis. Let us take calcite as an example. If we examine the image of the grating through a section parallel to the axis when the extraordinary ray is alone transmitted, the ordinary ray being cut off by a Nicol's prism, it will be found that there are two points separated from one another by an interval somewhat more than one-eighth of the thickness of the section, at each of which, only *one* system of lines can be seen *at once*, *i.e.*, at one focus: only the lines, say, from right to left are visible; at the other, only those from top to bottom can be distinguished. The image is thus truly *bifocal*. If we examine a circular hole, furnished by an iris diaphragm, through a unifocal or a bifocal crystal respectively in the first case, the image is seen undistorted and well defined at one focus, whereas in the bifocal image there is no focal point at which the hole can be seen of its true size and shape; it is either drawn out into a long vertical band with curved ends, or a horizoutal band, or forms a large circle without any definition. Crystals like aragonite, which have two optical axes, have no ordinary ray and no permanently unifocal images, but two bifocal images. With such a crystal a circular hole is drawn out into a cross. The lecturer then showed in what direction such crystals must be cut in order to obtain their true indices of refraction. The forms taken by gratings and circles were illustrated by models, and by means of the latter it was demonstrated that it was possible to tell at a glance in what direction a mineral had been cut in order to furnish the section under observation. The lecturer then proceeded to explain the application of this method of observation to rock section, and showed how valuable and simple the process was for identifying minerals. Even with sections 1-500th inch in thickness and 1-100th inch diameter good results have been obtained. The sections must be flat, and have parallel sides. They can be examined loose or mounted in Canada balsam, the method of observation being very similar to that described above in the case of liquids. Thus, in the meteoric irons of Krasnojarsk and Rittarsgrün, a clear mineral was proved to be olivine, and the three indices were found to be—

Krasnojarsk	1·71	1·68	1·68
Rittarsgrün	1·70	1·68	1·66
Olivine	1·70	1·68	1·66

In some cases it is better to compare the index of refraction of the unknown mineral with that of a known mineral, *e.g.*, quartz which is lying close to it. With very black horn-blendes good results can be obtained by using very thin sections, although the mineral is in moderately thin sections quite opaque. As an instance of the marvellously delicate nature of the method, the lecturer gave the examination of a section of a dolerite from near Glasgow, 1-400th of an inch thick. In this extremely thin section a zeolite, probably analcime, labradorite, caicite, and augite, were identified with almost absolute certainty. In a similar way, in sections of shells of *Pinna*, 1-1000th of an inch thick, calcite was recognised; whilst in a section of the shell of *Haliotis tuberculata* arragonite was identified. In conclusion, the lecturer referred to the connection between the indices of refraction and chemical composition. The subject is beset with difficulties, principally from defective data, but some points come out clearly. The fluorides have low indices of refraction; all the zeolites have indices less than that of quartz. All the earthy carbonates, sulphates, and borates have indices between those of quartz and corundum. All minerals with an index greater than that of corundum are metallic or metalloidal. Sulphur and sulphides have indices above 2·000, and the arsenides above 2·500. A mineral containing calcium instead of the alkalies has a higher index, *e.g.*, adularia, 1·52; labradorite, 1·61. Again, a mineral containing iron has a higher index than one in which calcium is substituted for that metal. Thus in the lime garnet, μ=1·74; in the precious garnet, μ=1·79. The lecturer finished by stating that much information might be obtained in a very short time by a qualitative examination of a mineral, *e.g.*, whether it was unifocal or bifocal, &c. The principal appearances described above were illustrated by specimens exhibited by the lecturer.

The President said that he was struck with the great extension of power with which this beautiful research of Mr. Sorby had furnished us. Such good results seemed possible with even one drop of liquid.

Mr. Duffy asked if the method had been applied to crystals, "raphides," or liquids in vegetable cells.

Mr. Sorby replied in the negative, and pointed out that the cell-walls would have to be perfectly flat in order to obtain results.

A hearty and unanimous vote of thanks was then given to Mr. Sorby for his elaborate and important communication, and the Society adjourned to April 18, when the following papers will be read:—"On Terpin and Terpinol," by Dr. W. A. Tilden; "The Poisonous Principle of *Urechites suberecta*," by J. Bowrey; "On the Temperature at which a few of the Alkaloids Sublime, as Determined by an Improved Method," by A. Wynter Blyth.

CORRESPONDENCE.

THE APPLICATION OF SONSTADT'S SOLUTION TO THE SEPARATION OF MINERALS FOR CHEMICAL ANALYSIS.

To the Editor of the Chemical News.

Sir,—I regret much that Mr. Sonstadt should imagine from my note on the above subject that I make any claim whatever with respect to the solution in question—than which nothing could be further from my intention—and fear he is a little too sensitive on that point; for, so far as I can see, I have simply followed Prof. Church in giving an example of how it can be successfully employed in the examination of minerals. The only difference is that Prof. Church, and indeed Mr. Sonstadt himself, appear to look upon the determination of gems and other minerals by their specific gravity alone as the most important use for it.

I wished simply to show that it was possible to collect by this means a sufficient quantity of a rare or finely diffused mineral from a mass of rock for analysis; and as I had not, and have not yet, heard of a specific case of such a practical application of the liquid to the purposes of chemical geology, I was anxious to make the process known to others who may also find it useful in the analysis of complex rocks, but many of whom probably, like myself, have not had an opportunity of seeing Mr. Sonstadt's original paper. (For I need not remind that gentleman that in these days of voluminous periodical scientific literature it is possible to overlook even an important paper.)

A mineral analysis, the material for which was obtained in this manner, may have been already published, but I have not seen it. Under these circumstances, I conceive that to refer to mine in such a qualified phrase as "perhaps the first" is not altogether unjustifiable, and until I hear of a previous one I shall beg leave to adhere to this surmise. To say that doing so lays claim to any part of Mr. Sonstadt's rights is much the same as if one of the many popular writers on the applications of the telephone were accused of trying to filch Mr. Bell's original ideas on that subject.

In conclusion, I can only hope that Mr. Sonstadt will, on reflection, feel as grateful to me for helping to bring his solution under the notice of geological chemists as I am to him for providing me with a liquid which has been, and I hope will again be, of the greatest use to me.—I am, &c.

Edward T. Hardman.

14, Hume-street, Dublin.
April 6, 1877.

MINERAL GROWTH.

To the Editor of the Chemical News.

Sir,—Allow me another word or two on this interesting subject. Since my last communication several of my recent *electrum-growths* have remarkably changed. But what I wish now to announce is, that I have observed an unmistakable tendency in some of the varied infantile shapes to assume definite isometric forms. In fact, three of them have crystallised *cubically* since the beginning of the present year. I may also mention that two *cube* electrum crystals have recently grown out of two hand specimens of Merioneth quartz, the surfaces of the quartz itself being (apparently) free of metallic sulphides, &c. I am inclined to think that recent inorganic growths of this kind may be very common, but I am not aware of such having been before observed and publicly recorded.—I am, &c.,

T. A. Readwin.

Liverpool, April 2, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 10, March 11, 1878.

Phenomena Connected with the Vision of Coloured Objects in Motion.—M. Chevreul.—The author announces his intention of putting forward three laws of the contrasts of colour: simultaneous contrast, successive contrast, and mixed contrast.

Relative Affinities and Reciprocal Displacements of Oxygen and the Halogens Combined with Metals.—M. Berthelot.—The comparative reactions of the halogens and of oxygen with the metals, the reciprocal displacements in particular between iodine and oxygen depend neither on the type nor on the formulæ of the compounds, atomic or otherwise. They depend on the quantities of heat liberated by the direct combination of the metals with each of the antagonist elements taken in equivalent weights. A knowledge of these quantities of heat suffices to foretell the nature, the peculiarities, and even the reversal of the reactions.

Vibrations of Matter and the Waves of the Ether in Chemical Combinations.—M. Favé.—The author sums up the hypotheses which he has employed in his former communications, namely:—The elements of ponderable matter execute incessantly short and rapid vibrations which elude human vision. These vibrations communicate their movement to the ether, forming in it waves proportional in length to the duration of the vibrations, and which are all propagated uniformly with the same speed. The waves of the ether intensify the vibrations of the bodies upon which they impinge whenever both are in accordance. The ether waves propagate themselves, meet, and cross, preserving each its individuality and its peculiar influence, each element of the ether obeying the resultant of the forces applied at the same moment upon each of its points. The ether waves, according to their length and intensity, and also according to the vibratory system of the bodies upon which they strike, produce either thermic, luminous, or chemical effects. These effects may be either separated, united, or combined two by two.

Industrial Applications of Electricity.—Th. du Moncel.—The author sums up a number of these applications, such as in silk-weaving and spinning, and in shuttles which have been very successful. Electricity also plays an important part in organs, pyrophones, metronomes, telephones of various kinds, printing and engraving machines, reading apparatus for the blind, thermometers, pyrometers, psychrometers, hygrometers, photometers, actinometers, sounding apparatus, &c. The most curious application, and that which engages most attention, is the electric light.

Variations of Terrestrial Magnetisn.—M. Quet.—The author announces his intention of entering upon a mathematical investigation of this subject.

Determination of the Principal Section of Nicol Prisms in Polarising Apparatus.—L. Laurent.—This can, according to the author, be effected with simplicity and precision by illuminating the apparatus with yellow light and interposing, between the analyser and the polariser a diaphragm, one-half of which is covered with a slender layer of quartz parallel to the axis and of the thickness known as half a wave.

Chloride of Sulphur.—M. Isambert.—The author proves that there exists merely a single chloride of sulphur in which chlorine is dissolved at low temperatures in considerable proportion. But from the non-existence of higher chlorides in a free state we are not entitled to deny their existence in combination.

Substitution of Sulphur for Oxygen in the Fatty Series.—A. Dupré.—The reaction of phosphorus oxychloride and the stability of the lead-salt seem to prove the existence of sulpho-propionic acid, an opinion confirmed by the action of sulphuretted hydrogen upon the nitriles, a reaction which gives rise to the sulphuretted amides recently described by Bernthsen as thio-acetamid and thio-propionamid.

The Catechins.—Arm. Gautier.—In this paper the author examines the catechins of Gambir, which have been hitherto confounded with those of the catechus properly so-called. In this substance he distinguishes three distinct compounds—

A .. .. $C_{40}H_{38}O_{16}$
B .. .. $C_{42}H_{38}O_{16}$
C .. .. $C_{40}H_{38}O_{16}$

The first melts at about 204°, the second at 176°, and the third at 163°. The whole catechin group, whether obtained from catechu or gambir, are characterised by turning green with ferric salts and giving a fine rose colour when successively treated with potassio-tartrate of iron and borax.

Action of Boric Fluoride upon certain Organic Matters.—M. Fr. Landolph.—An equivalent of benzylic aldehyd at its boiling point combines directly with an equivalent of boric fluoride, forming a compound which crystallises readily in white, brilliant laminæ. Ethylen, under the influence of direct solar light, combines with boric fluoride, forming a liquid compound, having the composition C_2H_3,BF_2.

Acid of the Gastric Juice.—M. Ch. Ricket.—The hydrochloric acid of the gastric juice occurs combined with tyrosin, leucin, and perhaps with other analogous bodies. Hence the gastric juice contains in reality a salt, formed of a feeble base, derived from the albuminoid matters.

On Garnierite.—M. J. Garnier.—The author gives to this mineral the following formula—

$$(MgO,NiO)SiO_2+nHO.$$

Not only are other elements, chrome, cobalt, copper, alumina, iron, &c., accidentally present, but the combined water varies from 5 to 11 per cent; there is no definite ratio between the quantities of magnesia and of nickel oxide present, these bases replacing each other in every proportion.

Archives Neerlandaises des Sciences.
Tome xii., 2me Livraison.

Reduction of Levulose.—H. D. Kruseman.—The author's results show that the reduction of levulose and that of glucose give rise to the same hexatomic alcohol, mannite. Mr. Dewar's question, if the mannite obtained by Linneman in the reduction of inverted sugar may have been derived from levulose as well as from glucose, must therefore be answered in the affirmative.

Tome xii., 3me Livraison.

This issue contains no chemical matter.

Tome xii., 4me Livraison.

Researches on the Origin of the Carbon of Plants.—J. W. Moll.—Carbonic acid supplied in excess to any part of a plant, subterranean or aërial, cannot develop appreciable quantities of starch in a leaf, or portion of a leaf, organicaliy connected to such part and placed in a space containing no carbonic acid. Carbonic acid supplied in excess to any part of a plant, subterranean or aërial, cannot accelerate in an appreciable manner in any leaf, or portion of a leaf, organically connected with such part, the formation of starch which takes place in the open air. The carbonic acid which the roots of a plant meet with in the soil is not able, either to determine the formation of an appreciable quantity of starch in the leaves of this plant when they remain in air free from carbonic acid, or to appreciably accelerate the formation of starch which takes place under the influence of the air alone.

Tome xii., 5me Livraison.

Researches on the Theory of Flames.—R. A. Mees.—The author reviews the two rival theories of the luminosity of flame: that of Davy, which ascribes the light to the incandescence of solid particles, and the more recent view of Prof. Frankland, who traces it to incandescent gaseous particles. M. Mees considers that all the phenomena hitherto observed may be explained by Davy's theory as well, if not better than by that of Frankland. He has also arrived at experimental results from which it appears clearly that the flame of carburetted hydrogen differs essentially from the majority of other flames which he has studied, and which render it very probable that there are actually solid particles in this flame.

Influence of Pressure on the Temperature of the Maximum Density of Water.—J. D. van der Waals.—The temperature of the minimum volume of water is lower as the pressure increases.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale.
No. 50, February, 1878.

Report Presented by M. Cloëz on Behalf of the Committee of Chemical Arts on the Methods for the Detection of the Presence of Alcohol in Mixtures Employed by M. Jacquemart.—The author states that the addition of wood-spirit to alcohol sold for manufacturing purposes at a reduced scale of duty is illusory, since it can be easily purified and sold as a beverage. To detect ethylic alcohol in mixtures M. Jacquemart uses the acid nitrates of mercury. If, when the reaction is at an end, a little ammonia is added a black precipitate is obtained, more or less intense, according to the quantity of alcohol present in the original liquid. Methylic alcohol treated in the same manner gives no black precipitate.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 8, February, 21, 1878.

Salt water is proposed as an agent for taking ink spots out of cotton goods.

Vegetable ivory is the name given by its inventor, M. Turpin, to caoutchouc hardened with magnesia.

It is proposed to extract formic acid and an especial oil, caloptine, from locusts and grasshoppers.

A new enemy to the vine has been recognised in the Anthragnosis, a species of fungus.

On the Telephone.—Prof. Du Bois-Reymond.—The author considers that the telephone possesses, as regards the physiology of language, an importance which has not yet been fully brought to light. The theory of the instru-

ment invokes no new principle, but what could not have been foreseen and what astonishes everyone is the energy with which the sounds are transmitted.

No. 9, February 28, 1878.

According to the *Journal d'Hygiène* a case of hydrophobia has been successfully treated by inhaling oxygen. The cure is said to have been performed by two Russian physicians, but the date and place are not given.

Reimann's Färber Zeitung,
No. 9, 1878.

Picrammate of ammonia, accordin to Dolfuss, is prepared by mixing a solution of 50 grms. picric acid in 700 grms. alcohol with 250 grms. ammonia, and passing through it a current of sulphuretted hydrogen. After expulsion of the sulphuretted hydrogen and the ammonia by heat there remains a mass soluble in water and capable of dyeing orange shades.

No. 10, 1878.

This issue contains nothing of general interest.

MISCELLANEOUS.

The Royal Society.—The following are the fifteen candidates selected by the Council for election into the Royal Society:—J. G. Baker, F.L.S.; F. M. Balfour; Rev. T. G. Bonney, M.A., F.G.S.; J. H. Cotterill, M.A.; Sir W. Elliot, K.C.S.I.; Rev. W. Greenwell, M.A., F.S.A.; T. Hawksley, C.E.; J. Hopkinson, M.A.; J. H. Jackson, M.D., F.R.C.P.; Lord Lindsay, M.P., P.R.A.S.; S. Roberts, M.A.; E. A. Schäfer, M.R.C.S.; H. Sprengel, Ph.D.; G. J. Symons; C. S. Tomes, M.A.

Russian Scientific News.—M. Eltekoff has found a new method for the synthesis of hydrocarbons of the type $CnHn_2$. On heating amylene with methyl iodide and lead oxide to 215° in sealed tubes, hexylene and heptylene are formed according the reactions:—

$$C_5H_{10}+CH_3I-HI=C_6H_{12}$$
$$C_5H_{10}+2CH_3I-2HI=C_7H_{14}$$

The C_7H_{14} obtained yields pentamethylethol—

$$[C(CH_3)_3.C(CH_3)_2.HO]$$

with sulphuric acid.

M. Slouginoff recommends carbon for the preparation of polarisation elements, such electrodes in acidulated water have a sufficient polarisation (2·28 Dan.)

M. Barchevsky long since (as the author understands), proposed the use of small fluorspar-sticks, pointed at their ends, as a substitute for the carbon-sticks for the electric light. Indeed, this old invention is worth studying again, as in using fluorspar-sticks an electric light of a sufficient brightness is obtained with a battery of 6 to 8 Grove's elements.

M. Setchenoff has made some experiments on the absorption of carbonic acid by—

1. Dialysed albumen from eggs with sodium hydroxide.
2. Casein whey with sodium carbonate.

Experiments proved that the absorption of the carbonic acid by these substances answers to the formation of the bicarbonate. The determination of carbonates in the whey is possible only in its diffusates, and even then only approximately, as the whey cannot be perfectly liberated from the salts it contains by dialysis.

S. KERN, M.E.

St. Petersburg.

COMPOSITION AND QUALITY OF THE METROPOLITAN WATER.

FEBRUARY, 1878.

THE following are the returns of the Society of Medical Officers of Health:—

	Appearance in 2 foot Tube.	Ammonia. Saline.	Ammonia. Organic.	Nitrogen as Nitrates, &c.	Oxygen used to Oxidise Organic Matter.	Total Solids.	Lime.	Magnesia	Chlorine.	Sulphuric Anhydride.	Hardness on Clark's Scale. Before Boiling.	Hardness on Clark's Scale. After Boiling.
		Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs
Thames Water Companies.												
Grand Junction	Clear	0·000	0·010	0·165	0·052	22·40	9·520	0·360	0·87	1·530	14·8	3·70
West Middlesex	Clear	0·000	0·009	0·159	0·063	21·40	9·940	0·420	0·87	1·600	13·7	3·30
Southwark and Vauxhall	Clear	0·000	0·009	0·150	0·049	21·90	9·340	0·500	0·87	1·500	14·3	3·30
Chelsea	Clear	0·001	0·009	0·165	0·052	21·40	9·250	0·390	0·87	1·500	14·3	3·30
Lambeth	Clear	0·001	0·009	0·165	0·045	23·60	9·520	0·420	0·87	1·500	14·8	3·70
Other Companies.												
Kent	Clear	0·000	0·003	0·315	0·003	28·40	10·840	0·680	1·37	2·830	18·8	6·50
New River	Clear	0·000	0·009	0·195	0·038	21·80	9·450	0·360	0·87	0·900	13·7	2·70
East London	Clear	0·000	0·009	0·135	0·066	24·90	9·530	0·640	1·08	1·930	15·9	4·20

The quantities of the several constituents are stated in grains per imperial gallon.

NOTE.—The amount of oxygen required to oxidise the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the Metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it

C. MEYMOTT TIDY, M.B

MEETINGS FOR THE WEEK.

MONDAY, April 15th.—Medical, 8.
TUESDAY 16th.—Civil Engineers, 8.
—— Zoological, 8.30.
WEDNESDAY, 17th.—Meteorological, 7.
—— Geological, 8.
THURSDAY, 18th.—Zoological, 4.
—— Chemical, 8. "On Terpin and Terpinol," Dr. W. A. Tilden. "On the Poisonous Principle of Urechites Suberecta," J. Bowrey. "On the Temperature at which a few of the Alkaloids Sublime as Determined by an Improved Method," A. Wynter Blyth.

NOTES AND QUERIES.

Yolk of Eggs.—Can any of your readers inform me whether the yolk of the egg is employed as a dye colour in calico printing, or is otherwise used in the arts? The oil of the yolk is employed in Russia in soap making. Has it any other commercial use, and how is it obtained from the yolk?—F.J.S.

Manufacture of the Salts of Ammonia.—Will any of your correspondents please inform me the best book published on the manufacture of the salts of ammonia (recent), also the best practical treatise on tar distilling.—C.H.

THE CHEMICAL NEWS.

VOL. XXXVII. No. 960.

NITRIC ACID IN THE VITRIOL MANUFACTURE.

By GEORGE E. DAVIS.*

IT is well known that nitric acid in the form of nitrate of soda is largely used in the vitriol manufacture; but why it should be so largely used when nearly every works of repute has a tower or towers for the absorption of once used nitrogen compounds is a mystery to many. Is the loss simply one of manipulation which could be prevented by better machinery or better working? or is there some process of destruction at work, by which the nitrogen compounds are rendered inactive or incapable of being taken up by the absorbing acid?

Many theories have been advanced upon this subject, and the pet theory of many workers in this field has been the reduction of the nitrogen compounds to nitrogen monoxide or even to nitrogen by contact with the hot gases from the pyrites burners.

Unfortunately for these theorists, this was avoided in one works with which I was connected by the introduction of the nitrogen compounds into the cooled gas, and I may say that the consumption of nitre at these works was a little in excess (if any) of the general average.

The loss of nitrogen compounds by reduction to nitrogen monoxide or to nitrogen must be very small indeed, as you will see by the results in a further portion of this paper, and I shall proceed to show that with the present system of working it is nearly impossible to produce vitriol profitably with towers with less than one ton of nitrate of soda for every 100 tons of pyrites burnt.

For in the Glover's tower there takes place between the nitrous vitriol and the gaseous sulphur dioxide, a reaction, by means of which the nitrogen compound is liberated, and immediately reduced to N_2O_2, and as such enters the chambers. The arsenic-acid which is present in the nitrosulphuric acid is at the same time reduced to arsenious acid, and as such leaves the concentrating or denitrating column.

In the Gay-Lussac or absorbing column another reaction takes place which causes nearly the whole loss of nitre. The strong acid which is run down this tower for the purpose of absorbing the nitrogen compounds contains arsenious acid, and by simply running down the tower comes out as arsenic acid. Now, wherever there is an oxidation there must be a reduction, except in the cases of elementary bodies being the active agents; in this case the arsenious acid becomes arsenic acid, the nitrogen trioxide becomes dioxide, which, being nearly insoluble in the strong vitriol, escapes from the tower. The amount of arsenious acid, then, which is put down the absorbing column is the measure of the limit of nitrate of soda which can be used.

It is easy to demonstrate the existence of this nitrogen dioxide in the escaping gases even when the exit is what is termed "sweet" and is colourless.

The exit gases when drawn through iodide of potassium solution liberate scarcely any iodine; but when drawn through a saturated solution of ferrous sulphate, the solution becomes brown and then black.

Having made a complete examination of vitriol exits of various kinds, I will lay them before you, and called A, B, C, D, E, F, G, not naming the works from which they were taken, while, at the same time, I may make a few remarks upon the working in each case, and mention anything which I think may contribute to explain the nitre losses.

The method used for the estimations in the following instances was:—A weighed quantity of *pure* caustic soda —or x c.c. of a normal solution, were placed in two aspiration bottles, with 20 c.c. of the strongest and purest obtainable hydrogen peroxide (free from H_2SO_4, HNO_3, HCl, and neutral when boiled); one cubic foot of the escaping gases was then drawn through the bottles when any sulphur compounds would form sulphate of soda, and the nitrogen compounds, from the dioxide upwards, would form nitrate of soda. The (1) acidimetric power was then taken, and the result calculated to grains per cubic foot of carbonate of soda neutralised by total acids; (2) the sulphuric acid was then precipitated (after acidifying), and weighed as barium sulphate, and calculated into grains of carbonate of soda, which that amount of sulphuric acid would neutralise. So the results are expressed as follow:—

(*a*) Grains of Na_2CO_3 neutralised by SO_3 from 1 cub. foot.
(*b*) ,, ,, ,, ,, N_2O_3 ,,
(*c*) ,, ,, ,, ,, total acids ,,

The speed of the draught in each case was taken with a tube anemometer, and the readings compared with the theoretical head of air calculated from the readings of 2 columns of ether in a U tube, one end inserted into the flue, the other open to the air. In several cases (2) the oxygen was determined. The speed given is the average of methods employed.

The nitrogen trioxide in the vitriol was determined by the mercury method.

In entering upon the description of these investigations, it will be as well to proceed in series, and in regular order, first starting with:—

A. Six chambers, all in one series, exit from last chamber going direct to chimney; escape tests taken during one week, when exit was sulphurous. Working badly.

B. From same works, when working well. Exit straw colour.

C. Nine chambers worked in three threes. The three exits collected in one steam tower packed with coke. Inlet to tower, straw colour. Exit from tower to chimney colourless. Working well.

D. Brimstone acid works. Four chambers worked in one series; exit from last chamber going direct to chimney. Working well.

E. Eighty-four tons Mason's pyrites burnt per week with an average consumption over three months of 1·26 per cent nitre. Two Glover's towers, one Gay-Lussac. Six chambers in one set.

F. Fifty tons Rio Tinto ore burnt per week. One concentrating column and one absorber. Four chambers in one set.

G. Eighty tons Rio Tinto ore burnt per week. Two concentrating columns, and one absorbing column. Eight chambers working in one series.

A.

In this works it was at one time thought better to use 3·4 per cent nitre, and let a little (!) sulphur dioxide go therefore, as the exit was sulphurous, you will not be surprised at the amounts of SO_3.

(1.)	*a.*	44·2
	b.	2·2
	c.	46·4
(2.)	*a.*	35·8
	b.	2·6
	c.	38·4
(3.)	*a.*	84·0
	b.	1·8
	c.	85·8

* A Paper read before the Faraday Club.

(4.) *a.* 17·0
b. 2·2
c. 19·2
Average one week. *a.* 22·0
b. 2·5 = 1·8 N_2O_3
c. 24·5

Area of exit pipe from chambers, 1·227 sq. ft.
Speed of draught = 7·4 feet per sec.
Nitrate of soda used per week, 34·5 cwts., which at 95 per cent = 14·6 cwts. N_2O_3.

Now, as we have 1·8 grains nitrogen compounds calculated as N_2O_3, and knowing the area of flue and speed of draught, we get:—

$$\frac{604800 \times 1{\cdot}8 \times 1{\cdot}227 \times 7{\cdot}4}{7000 \times 112} = 12{\cdot}6 \text{ cwts. } N_2O_3$$

escaping per week.

50 tons per week of vitriol, 123° Tw., were run from the chambers, and as it was mostly run from No. 3 chamber on account of that acid being of greater sp. gr., a large quantity of N_2O_3 was carried out with the acid. The vitriol contained 0·126 per cent N_2O_3 = 1·26 cwts. in the week.

We can follow, then, the following losses per week in cwts.

Lost by exit from chambers ..	12·60 cwts.
,, in chamber acid	1·26 ,,
Unaccounted for	0·74 ,,
Total N_2O_3 used	14·60 cwts.

B.

The same works as A, exit flue enlarged, and more nitrate of soda used = 4·7 per cent. The exit contained:—

(1.) *a.* 2·46
b. 2·40
c. 4·86
(2.) *a.* 0·43
b. 3·57
c. 4·00
(3.) *a.* 3·87
b. 1·50
c. 5·37
(4.) *a.* 0·34
b. 0·72
c. 1·06
Average one week *a.* 1·16
b. 2·52 = 1·8 N_2O_3
c. 3·68

Area of exit, 2·6 sq. ft.
Nitrate of soda used per week, 50 cwts., which, at 95 per cent = 21·2 cwts. N_2O_3.

Now, as we have again 1·8 grains nitrogen compounds per cb. ft., calculated as N_2O_3, we get:—
Taking quantity in cubic feet passing per second as 14—

$$\frac{604800 \times 14 \times 1{\cdot}8}{7000 \times 112} = 19{\cdot}4 \text{ cwts. } N_2O_3 \text{ per week.}$$

90 tons of vitriol at 123° Tw., run out of chambers per week containing 0·042 per cent N_2O_3 = 0·756 cwts. N_2O_3.
Following these figures we obtain—

Lost by exit from chambers ..	19·4 cwts.
,, in chamber acid	0·756 ,,
Unaccounted for	1·044 ,,
Total N_2O_3 used	21·200 cwts.

C.

This works producing well, had nine chambers, and doing only small work, they were arranged in three sets of three each. The exits from each set were collected and made to pass up a tower 5 feet sq. and thirty feet high filled with coke. Steam was admitted to this tower, and the acid trickling down ran out about 70° Tw. The gases were a straw-colour on entering this tower, but colourless upon leaving the top. The exit contained—

(1.) *a.* 0·22
b. 1·84
c. 2·06
(2.) *a.* 0·18
b. 1·62
c. 1·80
Average one week. *a.* 0·22
b. 1·50 = 1·07 N_2O_3
c. 1·72

Area of exit, 0·834 sq. ft.
Speed of draught, 12 feet per second.

Therefore, volume in cubic feet passing per second would be 10, nitrate of soda used per week 28 cwts., which, at 95 per cent, would give 11·87 cwts. N_2O_3.

Then, $$\frac{604800 \times 10 \times 1{\cdot}07}{7000 \times 112} = 8{\cdot}24 \text{ cwts. } N_2O_3$$

45 tons of acid at 123° were run from the chambers (from all the nine), containing 0·3 per cent N_2O_3 = 2·7 cwts.
From these figures we get:—

Lost by exit from chambers ..	8·24 cwts.
,, in chamber acid	2·70 ,,
Unaccounted for	0·93 ,,
Total N_2O_3 used	11·87 cwts.

D.

A brimstone acid works. Four chambers using 20 cwts. nitrate of soda per week. The sulphurous acid entered No. 1 chamber, and passed from No. 4 to the chimney. I had only an opportunity of examining this exit twice; but the working of the chambers never varied much:—

(1.) *a.* 0·82
b. 2·20
c. 3·02
(2.) *a.* 1·14
b. 2·00
c. 3·14

Average of the two trials = 1·5 grains N_2O_3.
Area of exit flue, 1 sq. ft.
Speed of draught, 6·4 feet per second.
Cubic feet passing per week, 3870720.

Then, $$\frac{387072 \times 1{\cdot}5}{7000 \times 112} = 7{\cdot}4 \text{ cwts.}$$

The vitriol run from the chambers weekly was 40 tons at 123° Tw., containing 0·04 per cent. N_2O_3 = 0·32 cwts. N_2O_3.
From these figures we get—

Loss by exit from chambers ..	7·40 cwts.
,, in chamber acid	0·32 ,,
Unaccounted for	0·78 ,,
Total nitrate (N_2O_3) used ..	8·50 cwts.

E.

Works using Tharsis ore, six chambers in one series, two Glover towers, one Gay-Lussac tower. Working very well. The exit tests were:—

(1.) *a.* 1·14
b. 0·51
c. 1·65
(2.) *a.* 2·26
b. 0·49
c. 2·75

Average (*b.*) = 0·35 grain N_2O_3.
Area of exit flue, 4 sq. ft.
Speed of draught, 8·5 ft. per second.
Cubic feet passing per week, 20563200.

Nitrate of soda used per week, 21 cwts. = 8·925 cwts. N_2O_3. 140 tons o.v. per week run down the Gay-Lusssc tower, containing 0·35 per cent As_2O_3 = 9·8 cwts. As_2O_3 per week, and according to the equation—

$$As_2O_3 + 2N_2O_3 = As_2O_5 + 2N_2O_2.$$

9·8 cwts. As_2O_3 would reduce 7·52 cwts. N_2O_3 to N_2O_2.

The o.v. running from the concentrating towers contained traces only of nitrogen compounds.

Now, $$\frac{20563200 \times 0{\cdot}35}{7000 \times 112} = 9{\cdot}18 \text{ cwts. } N_2O_3.$$

From which we get the following numbers :—

Lost by formation of nitric oxide ..	7·520 cwts.
,, imperfect absorption	1·660 ,,
	9·180

Which gives an access of 0·255 cwts. N_2O_3, and points to the fact that the average escape was not so great as shown by the two foregoing tests.

F.

This vitriol plant was badly arranged. There were four chambers, one concentrator, and one absorber. The acid was not all run down the concentrator. The No. 1 chamber was higher than the others, and its acid was run into No. 2, which was often highly charged with nitre. A great deal of vitriol was run to the pans direct from the chambers, and an undue proportion of concentrator acid was used in the absorbing column. Having to do more than its share of work in the concentrator, the nitre was high, on account of the large amount of arsenious acid which it contained.

110 tons of o.v. were run down the concentrator per week, containing 0·7 per cent As_2O_3 = 15·4 cwts. As_2O_3 per week.

The area of the exit flue was 4·17 sq. ft.

The speed of the draught 12 ft. per second.

Cubic feet passing per week, 30240000.

O.V. run from chambers 100 tons at 123° Tw. containing 0·05 per cent N_2O_3 = 1 cwt. N_2O_3.

Now the 15·4 cwts. arsenious acid would reduce 11·82 cwts. N_2O_3.

The nitre used per week was 32 cwts. = 13·6 cwts. N_2O_3.

I have no exit tests upon which I can rely from these works. nerefore I am obliged to sum up as follows :—

I ost by formation of As_2O_5	11·82 cwts.
.un away in chamber acid	1·00 ,,
Other losses	0·78 ,,
Total N_2O_3 used	13·60 cwts.

G.

The working of the chambers was very variable at these works. The chambers very old, and production not very good.

Area of exit flue, 5 sq. ft.

Speed of draught, 16 feet per second.

Cubic feet of gases passing per week, 48384000.

All the vitriol, without exception, run down the concentrating columns, and contained traces only of N_2O_3.

120 tons o.v. were run down the absorbing column per week, and contained 0·4 per cent As_2O_3 = 9·6 cwts. As_2O_3 per week.

Nitrate of soda used per week 42 cwts. = 17·8 cwts. N_2O_3.

Exit tests were :—

(1.)	*a.*	1·40
	b.	0·48
	c.	1·88
(2.)	*a.*	1·06
	b.	0·03
	c.	1·09
(3.)	*a.*	5·08
	b.	0·64
	c.	5·72
(4.)	*a.*	1·84
	b.	0·16
	c.	2·00

Average Na_2CO_3 neutralised by nitrogen compounds 0·33 = 0·23 grains N_2O_3.

The 9·6 cwts. As_2O_3 would reduce 7·3 cwts. N_2O_3.

Then, $$\frac{48384000 \times 0{\cdot}23}{7000 \times 112} = 14{\cdot}18 \text{ cwts. } N_2O_3.$$

We may, therefore, sum up as follows :—

N_2O_3 lost by As_2O_5	7·3 cwts.
,, imperfect absorption ..	6·88 ,,
Unaccounted for	3·62 ,,
Total N_2O_3 used	17·80 ,,

Upon looking back at these results, we find that where towers are not used (A, B, C, and D) the losses due to the escape of nitrous compounds from the chamber exit are :—

A.	86·3 per cent
B.	91·5 ,,
C.	69·4 ,,
D.	87·0 ,,

of all the nitrate used, and the percentages unaccounted for are—

A.	5·0 per cent
B.	4·9 ,,
C.	7·8 ,,
D.	9·1 ,,

upon the total nitrate used. A and B were very carefully watched, B over a long period, while C and D only occasionally watched.

With those works using towers, the results are very variable, E shows an excess. In F I caught the tower man dodging me when taking the exit tests; therefore have refrained from using any of the figures previously obtained. In G, there is a large amount unaccounted for, 20·3 per cent. These points want clearing up, and it may be worth while for some of the members of the club to work in this direction. In any circular process like the present, we can never expect to regain all the active material; but as this loss seems due to arsenic, I have constructed the following table from the data of E, F, and G, which shows in column 1 the number of cubic feet of air passing the exit per ton of o.v. at 123° Tw. per week. Column 2, per cent nitrate rendered useless by arsenic. Column 3, per cent run away in chamber acid. Column 4, disregarding all losses but those in column 2, contains the lowest per cent of nitrate of soda upon the pyrites burnt.

	1.	2.	3.	4.
E.	126933	81·9	traces	1·03
F.	302400	87·6	7·3	2·80
G.	336000	41·0	traces	1·13

Thus it will be seen that with the quantity of arsenic present in the vitriol, which was run down the absorbing columns in the instances E, F, and G, that the lowest percentage of nitrate of soda which could be used to keep the chambers nitrous was 1·03 per cent, 2·80, and 1·13 per cent respectively.

If we wish to use a lower percentage of nitrate of soda than this, we must use for absorbing an acid free from arsenious acid, and taking the figures obtained at works E, I do not see why the quantity of nitrate of soda used should not be brought down to 0·26 per cent upon the pyrites burnt, or to 2·91 lbs. of nitre per ton of o.v., made at 123° Tw.

I shall soon have an opportunity of testing the truth of my theories. I am now getting to work towers which will be supplied with sulphur acid free from arsenic, with several little self-acting arrangements to prevent loss o

nitre. In making the drawings for these towers I have made many experiments for my guidance which I cannot enter into now, but after I have got fully to work I shall have much pleasure in reading another paper before the members describing the construction of the plant, and giving the results of my working, so far as regards the nitre losses.

Barton Arcade, Manchester.
Feb. 20, 1878.

ACTION OF PERCHLORIDE OF IRON AND CONCENTRATED SULPHURIC ACID ON SOME OF THE BASES IN OPIUM.

By DAVID LINDO.

If a little codeia is placed in a small dry test-tube, dissolved in concentrated sulphuric acid *without* the aid of heat, and a drop of solution of perchloride of iron added; the latter will float on the surface of the mixture without giving rise to any characteristic colour; but on applying a gentle heat below the line of contact, and shaking the tube slightly, the fluid acquires an intense and magnificent blue colour, very similar to that produced by ammonia with salts of copper. The tube should not be more than one-fourth full. Morphia treated in the same way gives rise to an intense *indigo* blue colouration. Seen by candle light these colours appear violet.

On adding water to either of these solutions, the blue colour disappears. The fluid acquires a yellowish red colour, which is deeper with morphia than codeia.

I am not aware that these reactions have been noticed before. Want of material prevents me at present from trying the action of the test on the other opium bases.

Very small quantities of the alkaloids should be used in these experiments, or the colour will be so intense that the fluid will appear opaque, in which case, however, the addition of more concentrated sulphuric acid will render the tint apparent. The blue colour remains permanent for days if the fluids are kept in test-tubes, hut gradually changes on the surface from absorption of moisture.

Falmouth, Jamaica,
March 7, 1878.

THE NEW METHOD OF WEIGHING PRECIPITATES.

By CHARLES W. FOLKARD.

The interesting paper on this subject, by Mr. Clark, in the Chemical News of March 15th, will probably be of much value, by drawing the attention of chemists to a rapid, though perhaps somewhat rough, method of analysis. In chemical works especially, a determination, accurate to within 2 or 3 per cent, and obtainable in an hour, is often of far greater value than a regular analysis requiring a day or two to effect.

In November last, having occasion to boil down and crystallise a salt, formed by a double decomposition, in which sulphate of lime was one of the products, and wishing to get a result as rapidly as possible, I *estimated* the quantity of soluble matter left in the sulphate of lime, instead of washing it and boiling down the washings. To my astonishment I found that the precipitate from which the solution had been decanted, contained $\frac{23}{24}$ of its weight of clear solution, and the indicated sp. gr. of hydrated sulphate of lime was about 13·0. Being very busy, this was not followed up, and indeed had slipped my memory, but the paper by Mr. Cross (Chemical News, vol. xxxvii., p. 116), in which he observed that the indicated sp. gr. of ferric hydrate was about 10, reminded me of my own experience in the matter.

As to Mr. Cross's suggestion that the specific volume of ferric hydrate is variable "under identical conditions," this, to my mind, is a very hard matter to receive. If the numbers obtained by Mr. Cross as the weight of water displaced by a known weight of ferric hydrate, decreased slightly on digestion, the fact might be explained by the gradual increase of density, which many substances experience, and which is probably connected with their easier solubility when freshly precipitated.

But there is afterwards an increase in the numbers which is totally inexplicable.

It should be noted, however, that 1° F. makes a difference of 0·01 grm. in 100 c.c. of water, and with ordinary thermometers and specific gravity bottles (even with thermometer stoppers), it would be very difficult indeed to obtain results within one or two ten-thousandths. This being granted, it will be seen that the differences observed by Mr. Cross with ferric hydrate are in at least half the number of cases within the limits of errors of experiment. With regard to the silver determination, it seems to show that for heavy and anhydrous substances, the process would be very useful, but it would obviously conduce to the accuracy of the results if, when a 50 c.c. sp. gr. bottle is used, 10 grms. or more (if not too bulky) of the substance be taken.

As to our ignorance of the sp. gr. of precipitates recently thrown down, it would merely be necessary to determine this under certain known conditions, by taking a weighed portion of pure substance in the same way that solution of bichromate or permanganate is standardised for iron estimations, by means of pure iron (which method, by the way, is the only reliable one, even when the reagent, *e.g.* bichromate, is sufficiently definite and stable to admit of making up the standard solution by an exact weight dissolved in a definite quantity of water.) It would also be necessary for accurate estimations by this method to know the weight of water contained by the sp. gr. bottle at several temperatures, say 55°, 60°, 65°, and 70° F. (or even at less intervals), for every one is aware that it is impossible to obtain exact results when the temperature of the liquid differs more than 2° or 3° F. from that of the surrounding air.

With a few obvious precautions of this nature, Mr. Clark's process cannot fail to be of great value where time is an object.

Ranelagh-road, Ealing, W.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

April 13, 1878.

Prof. R. B. Clifton, Vice-President, in the Chair.

The following candidates were elected Members of the Society:—W. Campbell, R. W. F. Harrison, Rev. T. N. Hutchinson, M.A., B. W. Richardson, M.B., F.R.S.

The Secretary read a paper by Messrs. J. Nixon and A. W. Heaviside, describing their experiments on the mechanical transmission of speech through wires or other substances, to which Mr. Preece had referred at a previous meeting of the Society. After describing a number of experiments, in which metallic disks soldered on to the ends of the conducting-wires were employed, they went on to enumerate the more successful experiments, in which wooden disks were mainly employed. The first actual transmission of speech was effected by placing the belly of a violin against the receiving end of the wire, when every syllable spoken was distinctly audible. Very good results were obtained by employing mouth- and ear-pieces formed as in a telephone, the disk being replaced by thin wooden disks 6 inches in diameter, and a No. 4 wire was found to

be most satisfactory. On suspending a length of this wire in such a manner that it had no rigid attachments it was ascertained that 120 yards is the limit through which a conversation can be carried on.

Captain Abney, F.R.S., described the method he adopted for photographing the least refrangible end of the spectrum. He pointed out that it is impossible with the ordinary sensitive salts employed in the usual way to photograph further than the Fraünhofer line E, though by a preliminary exposure to light of a daguerreotype plate Draper was able to photograph beyond the extreme limit of visibility in the red end of the spectrum. This method, however, gave what is known as a reversed picture, the lights and shades being transposed, besides requiring a lengthened exposure. It enabled Becquerel to photograph the spectrum in its natural colours, and, later, St. Victor obtained coloured images of coloured cloths. The object of Captain Abney had been to obtain unreversed pictures of this portion of the spectrum: in other words, to obtain a compound that would be similarly sensitive to the red and the blue components of white light. Such a compound he had at last obtained by what he termed *weighting* silver bromide with resin, and now he obtains it by causing the molecules of silver bromide to weight themselves. He showed an ordinary bromide of silver plate, and the colour of the transmitted light was of a ruddy tint, showing absorption of the blue rays. Another film was shown, containing weighted bromide of silver, which transmitted blue light and absorbed the red. Photographic plates prepared with the latter compound he showed were sensitive to the red and ultra-red waves of light, and he threw on the screen photographs of the spectrum from the line C to a wave-length of 10,000, the ultra-red showing remarkable groupings of lines. He further showed that by friction the blue film was changed to the red, and in that state was not sensitive to the lower part of the spectrum. These photographs were taken by means of a diffraction grating, and Captain Abney demonstrated Fraünhofer's method of separating the various orders of spectra produced by it. He then explained that recently he had elucidated the reason of the reversal of Draper's pictures by the least refrangible end of the spectrum. He finds that it is accelerated by exposing the plates in weak oxidising solutions, such as those of hydroxyl, bichromate of potash, permanganate of potash, and nitric acid, or exposure to ozone. The red rays, in other words, seemed to oxidise the photographic image, and to render it incapable of development.

Mr. H. Bauerman then exhibited some paper models, illustrative of the disposition of the planes of symmetry in crystals. These included octants of the sphere with enclosed cube and octahedron faces pointed into their corresponding hexakis octahedral faces, a cubic skeleton built up from nine planes of symmetry, with a removable outer shell, and a system of axial planes of an unsymmetrical mineral, enclosing a solid nucleus contained between three parallel pairs of planes. They were constructed for the purpose of showing popularly the difference between planes of symmetry and other diametral planes by laying upon them a small mirror or plate of mica, when, in the first case, the enclosed nucleus gave a symmetrical image corresponding in position to the plane immediately behind the mirror, but in the second a broken image is produced.

Dr. Guthrie exhibited the arrangement of apparatus he had employed, in conjunction with his brother, to ascertain the effect of heat on the transpiration of gases. The main difficulty connected with the research was the securing of an absolutely constant pressure on the air operated upon. This was secured by inserting into the neck of the vessel which served as an air-chamber a tube turned up at its inner end and terminating externally by a small funnel; as the tube was kept constantly full of water, the funnel overflowing, a pressure represented by the difference between the heights of these levels was maintained. After passing through a series of drying tubes the air traversed the (U-shaped) capillary tube in a beaker containing water of known temperature, and was finally received in an inverted tube contained in an overflowing disk of water. Among other results it was found that the resistance of a tube is the same as that of its several portions, and if t be the time occupied, T the absolute temperature, P_1, P_2 the pressures, and α and β constants, they find that—

$$t = \alpha T\left(T + \frac{\beta}{P_1 - P_2}\right).$$

NOTICES OF BOOKS.

A Treatise on Photography. By W. de Wiveslie Abney, F.R.S., Captain in the Royal Engineers, &c. Longmans and Co. 1878.

Captain Abney's work forms one of the admirable series of "Text-Books of Science" now in course of publication by Messrs. Longmans. In this treatise Captain Abney enters more fully into the history and theory of photography than any other purely English author has done since the days of Hardwich. He opens with a short account of the early discoveries of Scheele, Ritter, Wedgwood, Niepce, Daguerre, Talbot, Herschel, Scott Archer, and others. In speaking of Wedgwood's discoveries the author calls attention to a strange misconception with regard to the paper read by Wedgwood at the Royal Institution, entitled "An Account of a Method of Copying Paintings on Glass, &c." The vague wording of this title has led certain writers to claim for Wedgwood the credit of having been the first to take a glass negative; but the real fact of the matter is that Wedgwood did not make photographs on glass, but only copied designs which were drawn or painted on that material. The second chapter gives us a general account of the properties of light in relation to photography, the third chapter being devoted to a very lucid explanation of the theory of the action of light on sensitive compounds. Chapter IV. gives an account of the action of light on the different salts of silver, iron, uranium, and chromium; also on asphaltum, dyes, and a mixture of chlorine and hydrogen. In connection with this subject Captain Abney mentions a curious fact that does not seem to be generally known. Mr. F Jones, of Manchester, has discovered that if we expose sulphur to sunlight in an atmosphere of antimony or arsenic hydride, we get antimony or arsenic sulphide and hydrogen sulphide. This discovery ought to open up a wide field of research into the effects of light on similar substances. We are so accustomed to investigate the properties of compounds which have been formed or broken up under the influence of light that we are totally unacquainted with the reactions which go on or do not go on in darkness. Chapter VI. treats of the Daguerreotype, but seeing that this process has lately been resuscitated for certain astronomical work it might well have been made longer. Has the Daguerreotype ever been used for spectroscopic photography? Surely some process of etching the silver plate and printing from it direct might be devised. A rigid metallic plate would be infinitely more trustworthy for such work than an unequally contractile collodion film. The chapter on "Defects in Negatives" will soothe the troubled spirits of many amateurs and professionals. The various dry-plate and emulsion processes next come in for treatment, the same judicious mixture of practice and theory being still kept up, little experiments being given here and there confirmatory of the author's views. Printing in all its branches, both on paper and glass, and the toning and fixing processes, next receive attention, the various tissue, gelatine, Woodburytype, relief, and autotype processes being fully explained and their special merits discussed. Actinometry, photospectroscopy, celestial photography, and micro-photography end the book. The chapter on "Miscellaneous

Applications of Photography" might have been made longer, a remark that will apply to several other chapters in the book. The scientific chemist who perhaps has never coated a plate in his life will find a number of interesting theoretical considerations dispersed through the book which he may read with both pleasure and profit. The book is illustrated with a large number of excellent woodcuts, and is printed in clear legible type; the index, however, might have been made a little more copious.

Mineralogy. By J. H. Collins, F.G.S. Vol. I. The General Principles of Mineralogy. London and Glasgow: W. Collins, Sons, and Co.

This volume forms one of Collins's Advanced Series, and is designed to give those students who have not had a mathematical training a good insight into the principles of crystallography, a branch of science which has been strangely neglected of late years. Thn system adopted is that of Prof. Miller, of Cambridge. Clear directions are also given for the measurement of the angles of crystals, a subject which has been surrounded with an unnecessary amount of mystery. The various physical properties of crystals are also described. The article on "Blowpipe Analysis" is unnecessarily meagre, a remark that will apply with equal force to the index. This defect, however, is perhaps more the fault of the publisher than the author. Vol. II., which will shortly be published, will treat of systematic mineralogy. The work is illustrated by nearly six hundred woodcuts and diagrams.

Science for All. Illustrated. Parts I. to IV. London: Cassell, Petter, and Galpin.

Science for All is a new monthly journal of every-day science which is intended to fill up the wide gap at present existing between the numerous periodicals intended for professional scientific men and the many childish and misleading so-called popular scientific articles which we so frequently find occasion to laugh at in the daily and weekly press. The Jablochkoff Electric Candle, the Colorado Beetle, and the Telephone produced a plentiful crop of these. The articles in *Science for All* embrace the whole range of Natural Science, and are written in a style within the ken of any ordinarily well educated reader. An article on Limestone, by Prof. Nicholson, of St. Andrews; an excellent one on "Ice, Water, and Steam," by Mr. J. E. H. Gordon, of Cambridge; another on the "Chemistry of a Brewer's Vat," by Mr. W. B. Ferguson, of Oxford, may be taken as specimens of what good popular scientific writing should be. An article on "Whirlpools and Whirlwinds," by Mr. W. Ackroyd, is also an excellent type of its class. Beginning with the familiar whirlpools which we set up in our teacups when we endeavour to melt a refractory lump of sugar in our tea, Mr. Ackroyd leads his reader past the Malström and Charbydis; introduces him to the Bell Animalcule; shows him an Indian dust-whirlwind at a distance; teaches him how to make smoke rings and liquid vortex rings; and finally lands him in the midst of Professor Thomson's Theory of Vortex Atoms. The articles on Astronomy, by Mr. R. A. Proctor; on Hunger, by Mr. R. Wilson; and on several other subjects, which are beyond our scope, are excellent in their way. The new journal is ably edited by Dr. Robert Brown, F.L.S., formerly Lecturer on Geology and Physical Geography in the School of Arts, Edinburgh, and author of one of the best elementary manuals of botany which we possess. Dr. Brown himself contributes two excellent articles, one on "A Highland Glen," and another on "A Fallen Leaf." The journal is well illustrated with numerous woodcuts and a coloured lithograph showing the succession of rocks which constitute the crust of the earth.

CORRESPONDENCE.

THE APPLICATION OF SONSTADT'S SOLUTION TO THE SEPARATION OF MINERALS FOR CHEMICAL ANALYSIS.

To the Editor of the Chemical News.

Sir,—In my paper on some uses of Sonstadt's solution, in the *Mineralogical Magazine* for November, 1877, I say:—"More than this, two minerals, if of different specific gravities, provided one is less than S.G. 3·0, may often be easily separated from one another, if they are in fragments of appreciable size. . . . A very simple apparatus is required for this purpose. . . . A few repetitions of the process seldom fail in effecting such a separation in an hour as would have taken days, or have been impossible by the ordinary method of mechanical selection." It is scarcely necessary to state that chemists are not in the habit of making laborious separations of mixed crushed minerals except for the purpose of subsequent chemical analysis of the selected fragments. The above quotation, which summarises my three or four years' experience in the use of Sonstadt's solution for the separation of minerals from each other for the purposes of analysis, should suffice to show that I do not look upon the distinguishing of different gems as the most important application of this liquid. Several of my recent contributions to mineralogical chemistry could not have been made without its assistance: several rare specimens of mineral phosphate, wholly entangled in a siliceous gangue, have been isolated in a condition of perfect purity by its means. I have often identified the minerals of a crushed fragment of rock by introducing a drop of the solution into the "live-box" under the microscope. By using solutions of increasing strength, or adding the solid salt, the felspars, the quartz, and then some of the heavier minerals may be successively brought to the surface, and thus into focus. But this and other applications of the solution naturally flow from Sonstadt's original suggestion.—I am, &c.,

A. H. Church.

P.S.—I see in a recent number of the *Comptes Rendus* that a M. Thouret has just made the discovery that a solution of mercuric iodide in a solution of potassium iodide may be employed for the purposes to which Mr. Sonstadt and myself have so long put it.—A. H. C.

WEIGHING PRECIPITATES.

To the Editor of the Chemical News.

Sir,—The Chemical News is always very welcome out here, and I trust you will kindly excuse this little effusion from the Arctic backwoods on account of the interest taken by the writer, through the Chemical News, in chemical matters. Permit, therefore, dear Sir, my reference to Mr. Clark's article, "On a New Method of weighing Precipitates" (vol. xxxvii., p. 109). The method is not new, as I have read a full description of it in a number of the *Journal für Praktische Chemie* in 1861 or 1862. I then have tried it repeatedly, but had to abandon it because in—

$$\frac{Ca}{a-1}$$

a is found by weighing, and being always in the divisor, the slightest mistakes are magnified thereby to such an extent as to render it unreliable. I remember to have tried to eliminate a, or to change the equation, but did not succeed. Could this be done a very great advantage would doubtless result.—I am, &c.,

Dr. Volney.

The Volney Powder Works, Brockville,
March 30, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Berichte der Deutschen Chemischen Gesellschaft, No. 1, 1878i

Transformation of Nitriles into Amides.—A. Penin and Fr. Klein.—The authors describe a compound which was briefly mentioned in a former communication and which is a polymerised benzonitrile, C_7H_5N, and in all its properties identical with the kyaphenin obtained by Cloëz by the action of potassium cyanate and chlor-benzoyl. They have obtained benzimido-amide, $C_7H_8N_2$, by the action of cold soda-lye upon its hydrochlorate, and have examined its behaviour with various reagents.

Relations between the Atomic Weights of the Elements.—Fr. Waechter. (Table I.).—The Table I. expresses the mutual relations of the various groups. The horizontal lines contain analogous elements of similar valence, whose equivalents increase approximately by a multiple of 16 units. In the vertical columns the elements rank according to their decreasing atomic weights, the valence in each case rising and falling in the series I., II., III., IV., III., II., I.

	a.	*a*+(1·16).	*a*+(2·16).	*a*+(3·16).	*a*+(4·16).	*a*+(5·16).	*a*+(6·16).	*a*+(7·16).	*a*+(8·16).
Univalent ..	Fl = 18·960	Cl = 35·457	—	—	Br = 79·952	—	—	I = 126·85	—
Bivalent ..	O = 16·000	S = 31·978	—	—	Se = 79·480	—	—	Te = 128·000	—
Trivalent ..	N = 14·044	P = 31·045	—	—	As = 74·915	—	—	Sb = 122·265	—
Quadrivalent	C = 11·970	Si = 28·050	—	—	76	—	—	—	—
Trivalent ..	Bo = 10·800	Al = 27·480	Y = 46·200	—		—	—	—	Di = 138·100
Bivalent ..	Be = 9 300	Mg = 24·380	Ca = 39·974	—		—	—	—	Ba = 137·166
Univalent ..	Li = 7·022	Na = 23·043	K = 39·137	—		—	—	—	Cs = 133·036

This arrangement brings to light the following points:—(1). The affinity of the elements decreases from fluorine to silicon with the increasing atomic weight and valence; from silicon to cæsium it increases with the still rising atomic weight, but with the falling valence. The two end members, fluorine and cæsium, have the strongest but opposite affinities; the remaining elements have feebler affinities the nearer they approach the middle of the series. If the strength of the affinity of an element in comparison with the affinity of another element is decided according to the manner in which decompositions take place (if, *e.g.*, potassium decomposes sodium chloride or sodium potassium chloride) the above proposition comprehends 6706 cases of decomposition. By means of experiments already made, however, and from analogy it can only be maintained that 658 cases of decomposition occur in accordance with the above law, while 26 cases are contradictory. No data exist for the decision of the remaining 5922 theoretically possible cases of decomposition. (2.) The arithmetical mean of the atomic weights of two elements of equally intense but opposite affinity is approximately 76. If the amount of heat appearing on a chemical combination is regarded as the measure of chemical affinity, according to proposition 2, the same amount of heat must be liberated when equal quantities of iodine and magnesium, or of tellurium and sodium, enter into combination. (3.) The melting-points and boiling-points of the elements named in the table increase from fluorine to silicon with the increasing atomic weight and valence; from silicon to cæsium they decrease with increasing atomic weight and still falling valence. Of 22 melting-points 20 agree with this proposition, while 2, phosphorus and silicon, disagree. Out of 10 boiling-points 9 agree. (4.) The specific heats of the elements contained in the table, as far as known, decrease with the increasing atomic weight and valence. (5.) The specific gravity of the elements in the table in the solid state is in corresponding tomic weights (those in the same perpendicular series), the greater, the higher is the valence. (6.) The affinity of the negative non-metallic elements—fluor and silicon—for the true metals decreases with the increasing atomic weight and valence.

Xylol-sulphonic Acids and Xylenols.—Oscar Jacobsen.—A lengthy memoir, not adapted for useful abstraction.

Pseudocumenol and Constitution of Pseudocumol-sulphonic Acid, Durol, &c.—Aug. Reuter.—Pseudocumenol, $C_9H_{11}OH$, is easily volatilised along with watery vapour, and congeals chiefly in the refrigerator to a white crystalline mass with an odour of phenol. It melts at 69°, and boils at 240°. It is almost insoluble in cold water but very readily soluble in alcohol and ether. The solutions are not coloured by ferric chloride.

Certain Derivatives of Pseudocumol-sulphonic Acid.—J. Radloff.—The author has prepared pseudocumol-sulphochloride; pseudocumol-sulphinic acid, with certain of its salts; pseudocumol-sulphydrate, and pseudocumol-disulphide.

Vapour-Tensions of Certain Chemical Compounds and their Determination.—Alex. Naumann.—The author gives the vapour tensions of toluol, nitrobenzol, ethylbenzoat, naphthalin, and anthraquinon.

Reduction of the Nitro Compounds with Stannous Chloride, and Quantitative Determination of the Nitro Group.—H. Limpricht.—The reduction of nitro compounds is better effected with an acid solution of stannous chloride, in place of granulated tin and hydrochloric acid. The nitro compound to be reduced is added to the clear acid solution of stannous chloride containing about 150 grms. tin per litre. The reaction as a rule takes place without the aid of heat, and if the quantities are large the liquid may run over. The author was led to apply this reaction to the quantitative determination of the group NO_2 in organic compounds. If a weighed quantity of an organic nitro compound is heated with a known volume of solution of stannous chloride of known strength the transformation of NO_2 in NH_2 takes place according to the equation:—

$$NO_2+3SnCl_2+6HCl=NH_2+3SnCl_4+2H_2O.$$

The quantity of NO_2 in the nitro compound can then be found from the excess of unconsumed stannous chloride, the amount of which is readily and accurately determined by titration.

Quantitative Determination of NO_2 in Nitro Compounds.—H. Limpricht.—The author returning to the subject treated in the last paper describes certain additional precautions required for volatile substances.

Schizomycetenic Fermentations, No. III.—A. Fitz.—A thorough examination of the fermentation induced in various organic bodies by the Schizomycetes or split fungi. The author considers that in the fermentation o starch induced by *Bacillus subtilis* butyric acid is produced directly without the appearance of lactic acid as an intermediate product.

On Betulin.—A. P. M. Franchimont.—The author announces that H. Wigman has been engaged in his laboratory with the examination of betulin, and has arrived independently at results similar to those just published by MM. Paterno and Spica.

On Para-iodo-benzyl Compounds.—C. F. Mabery and C. Laing Jackson.—An account of para-iodo-benzyl-

bromide, para-iodo-benzylic-alcohol, para-iodo-benzyl-cyanide, para-iodo-alphatoluylic acid and its salts.

Action of Sodium on Ethoxacetic-ester. — Max Conrad.—The author has repeated the experiments of Geuther on this subject.

Method for the Separation of Crystalline Silicic Acid, especially Quartz, when mixed with Silicates. — E. Laufer. — The author takes advantage of the property of phosphoric salt to dissolve metallic oxides at a melting heat, and to isolate silicic acid from silicates without attacking quartz. To the finely powdered material weighed in a platinum capsule, phosphatic salt was added in a larger quantity than was required for the solution of the silicates supposed to be present, the crucible not being more than half full. It was gradually and cautiously heated in the air-bath, then melted, the heat being finally urged with the blast till the mixture was in tranquil fusion. The cold mass was easily separated from the crucible, and was then boiled for a length of time with dilute hydrochloric acid, washed by decantation, and filtered, the silicic acid being then extracted from the residue with boiling soda.

Action of Sodium upon Monochloro-ethylen-chloride.—H. Brunner and R. Brandenburg.—The resulting substances are acetylen, ethylen, dichlor-ethylen, and hydrogen.

Reply to the Renewed Attacks of H. Moritz Traube.—F. Hoppe-Seyler. — A controversy regarding priority, H. Traube maintaining that he has essentially anticipated H. Hoppe-Seyler's theory of fermentation.

On Pinakones and Pinakolines.—W. Thörner and Th. Zincke.—The authors here describe the benz-pinakolines and the tolylphenyl-pinakolines.

On the Substances formed from Hydro- and Isohydro-benzoin by the Action of Dilute Sulphuric Acid.—A. Breuer and Th. Zincke.—In a previous communication the authors have considered the two substances in question as simple aldehyds of the two alcohols—physically distinct, though chemically identical—hydro- and isohydro-benzoin, and they find this view confirmed by their subsequent researches.

Action of Iodine upon Phenylated White Precipitate. — Ch. Rudolph. — The substances formed are di-iod-aniline and mono-iod-aniline.

Anthraquinon Carbonic Acid, Oxyanthraquinon Carbonic Acid, and Alizarin Carbonic Acid.—W. Hammer schlag.—The first-mentioned acid is obtained by dissolving methylanthraquinon in glacial acetic acid, and keeping it at a boil for six hours with an excess of chromic acid. The product, when cold, is diluted with water, filtered, washed, boiled with a slight excess of caustic soda, and filtered whilst hot. On adding hydrochloric acid to the filtrate, anthraquinon carbonic acid is deposited as a very voluminous curdy precipitate. It is soluble in glacial acetic acid, and crystallises in long thin needles, scarcely to be distinguished from anthraquinon, and melting at 280°. Its composition is—

$$C_{15},H_8,O_4.$$

Oxyanthraquinon Carbonic Acid.—If the sodium salt of the former acid is fused with 6 parts of caustic soda, and maintained for about 6 hours at 200°, a coloured melt is obtained, which might be mistaken for alizarin, but which is the sodium salt of the new acid. If it is dissolved in water, and precipitated, while boiling, with hydrochloric acid, a deposit of orange-yellow flocks is obtained, closely resembling alizarin. It is, however, distinguished from all the oxyanthraquinons by its perfect solubility with a brown-red colour in sodium acetate, or ammonium oxalate, in which the oxyanthraquinons are insoluble. Its composition is $C_{14}H_6(OH)(COOH)O_2$. Alizarin carbonic acid, or as the author considers it, dioxy-anthraquinon carbonic acid, consists of $C_{15}H_8O_6$. The author gives a comparative table of the respective reactions of monoxy-authraquinon carbonic acid, and o dioxy anthraquinon carbonic acid, and adds a speculative appendix on the constitution of anthraquinon carbonic acid, of mono- and dioxy-anthraquinon carbonic acids of purpurin, and purpuroxanthin carbonic acids of methyl-anthraquinon, and methyl-anthracen.

On Certain Double Salts of Thallous Cyanide, and on a new Thallous Thallic Cyanide.—C. Froumüller. —The double salts examined and described by the author are the thallio-cyanides of silver, zinc, mercury, and cobalt. The thallous-thallic cyanide, $Tl_2C_4N_4$, is formed by treating thallium oxide with a solution of hydrocyanic acid (containing about 20 per cent of dry acid) in the cold. The author has also obtained thallium sulphocyanide, by treating the last-mentioned compound with sulphuretted hydrogen.

On Benz-erythren.—G. Schultz.—The author obtained benzerythren among the products formed by passing benzol through an ignited tube. It is insoluble in water, almost insoluble in alcohol, scarcely soluble in boiling glacial acetic acid, and in cold benzol, though it is readily taken up by the latter solvent with the aid of heat, and crystallises on cooling in small shining leaflets, which melt at 307-308°. It is not identical with Rasenack's parachrysen.

The Meteor of Sokol Banja in Servia.—S. M. Losanitch.—The meteor in question fell on Oct. 1/13, 1877, about 2 p.m. It consists of—Metallic iron 3·8, silicate 96·2, and in addition some iron pyrites. The pure fragments of iron contain—

Fe	78·13
Ni	21·70
Cu	0·17
	100·00

The iron pyrites is a monosulphide, containing no copper and mere traces of nickel. In the silicated mass a small amount of chrome-iron was detected.

Sulphates of Vanadium Pentoxide.—B. W. Gerland.—The compounds examined are—

$$V_2O_53SO_3V_2O_52SO_3,V_2O_23SO_4$$

vanadylid sulphate, which forms double salts with potash and ammonia, but not with soda or magnesia.

Action of Chloride of Iodine upon the Aromatic Amines.—A. Michael and L. M. Norton.—The authors have examined the action of chloride of iodine upon acetanilid; of two mols. chloride of iodine upon 1 mol. acetate of aniline; of 3 mols. chloride of iodine upon 1 mol. anilin hydrochlorate; of chloride of iodine upon metanitraniline, para-nitratiline, and paratoluidin hydrochlorate.

Aromatic Sulphones.—A Michael and A. Adair.—(Second part.) An examination of phenyl-tolyl-sulphon, $C_{13}H_{12}SO_2$; para-sulpho-benzid carbonic acid,—$C_{13}H_{10}SO_4$ and sulpho-benzid-dicarbonic acid, $C_{14}H_{10}O_6S$.

On Derivatives of Methylated Protocatechuic Acids.—Kaeta Ukimori Matsmoto.

On a Dimethyl-oxylated Benzoyl Carbonic Acid belonging to the Protocatechuic Acid Series, and its Relation to Alpha-homo-veratric Acid (Dimethyl-alpha-homo-prote-catecouic Acid.)—F. Tiemann and Kaeta Ukimori Matsmoto.—These two papers are not adapted for abstraction.

Bulletin de la Société d'Encouragement pour l'Industrie Nationale.

No. 51, March, 1878.

Report Presented by M. Bérard on Behalf of the Committee of Chemical Arts on M. Houdart's New Process for the Determination of the Dry Extract of Wines.—This process applies merely to the ordinary qualities of wine in daily consumption. M. Houdart, after having distilled off the alcohol, dilutes the residue with water sufficient to reproduce the original volume, and

takes its specific gravity with the hydrometer. The results thus obtained appear to bear a definite relation to the quantity of fixed solids present in the wine.

Detection of Fatty Bodies Fraudulently Introduced into Butter.—C. Husson.—The author's process is too lengthy for a full description. He places in each of a number of test-tubes 10 grms. of the whitest castor oil, and adds to one 1 grm. of the sample to be examined, and to the others 1 grm. each of the various fatty matters with which the butter is likely to be sophisticated. The tubes are then plunged in the water-bath and the appearances presented at different temperature are noted. The mixtures are then treated with cold alcohol at 90 per cent, the emulsions formed are filtered, the residue washed with more alcohol, and dried in a current of air. One grm. of tallow thus leaves a deposit of 1·20 grm., whilst pure butter yields only 0·70. The author also dissolves fats in equal weights of glycerine, heating, agitating, and treating the emulsion formed with an equal weight of alcohol at 90 per cent, and of ether at 66 per cent. The tubes containing these mixtures are placed in the water-bath, maintained at 25°, and the strata of liquid produced are examined. With pure butter the lower stratum is slightly opalescent, the more decidedly the more milk is shut up in its texture. With margarine, lard, tallow, &c., this phenomenon is, of course, wanting. The tubes are afterwards withdrawn from the water-bath, let cool to 18° or 20°, and the deposits produced are examined with the microscope.

Les Mondes, Revue Hebdomadaire des Sciences, No. 10, March 7, 1878.

A Little about Telephony.—J. Luvini.—This paper cannot be reproduced without the accompanying diagrams.

Part Played by Ferments in the Nutrition of Plants.—M. Morren.—The author shows that digestion depending upon the action of ferments is not exclusively peculiar to carnivorous plants, but is common to all vegetables.

Reimann's Färber Zeitung, No. 11, 1878.

Dr. Reimann finds that the milk of sulphur is utterly useless as a mordant for eosin, its supposed beneficial action being due to a small excess of hydrochloric acid added along with the hyposulphite of soda.

MISCELLANEOUS.

Dublin University Experimental Science Association.—The second general meeting of the session was held in the Museum Buildings (New Square), Trinity College, on Wednesday, April 10, 1878, Prof. Emerson Reynolds, M.D., in the Chair. The following communications were made:—Denis M'C. Mahony, B.A., "On the Triatomicity of the Halogens;" E. P. Culverwell, B.A., "On the Appearance presented by Rainbows on Different Planets;" J. D. Pratt, B.A., "On the Estimation of Free Carbonic Acid in Water with the aid of Phenol-phthalein;" Messrs. Coffey and Falkiner, "On the Action of Sodic Hypobromite on Ammonic Sulphocyanate and on the Sulph-urea." The meeting then adjourned.

South London School of Pharmacy.—On Monday, April 15 (being the first day of the third term of the session), the Secretary, Mr. Baxter, presented the medals and certificates to the following successful competitors:—Medal, Senior Chemistry, Mr. Hutton; Medal, Junior Chemistry, Mr. Davies; Medal, Materia Medica, Mr. Parker; Medal, Botany, Mr. Stonham; Medal, Pharmacy, Mr. Richards; Certificate, Senior Chemistry, Mr. Barrow; Certificate, Junior Chemistry and Materia Medica, Mr. Richards; Certificate, Botany, Mr. Nicholson; Certificate, Pharmacy, Mr. Pocock.

NOTES AND QUERIES.

Ansell's Fire-Damp Indicator.—In volumes xii. and xv. of the Chemical News there is described an apparatus for the detection of fire-damp in mines by means of diffusion. Can any of the readers of the Chemical News inform the writer if this apparatus has ever been in practical use, and, if so, where? If it has not been, what have been the objections to it, and, otherwise, has it failed to answer the purpose? The late numerous explosions in mines make it desirable that some means to detect a sudden outburst of fire-damp should be found, and Ansell's apparatus seems, if there be no practical objections to its use, to answer the purpose.—H. C. S.

TO CORRESPONDENTS.

M. H. Coehrane.—The Chemical Society could not interfere in the matter you refer to.

P. Campin.—No such process is known.

T. H. Davis.—Apply to Messrs. Hachette or to Messrs. Baillière.

G. H. Sharpe.—You had better advertise. We do not know of any such appointment vacant.

MEETINGS FOR THE WEEK.

Tuesday 23rd.—Civil Engineers, 8.
Thursday, 25th.—London Institution, 12. (Anniversary.)
Friday 26th.—Quekett. 8.
Saturday, 27th.—Physical, 3.

ROYAL INSTITUTION OF GREAT BRITAIN
ALBEMARLE STREET, PICCADILLY, W.

LECTURE ARRANGEMENTS AFTER EASTER, 1878.

Lecture Hour, Three o'Clock.

W. T. THISELTON DYER, M.A., B.Sc., F.L.S., Assistant Director, Royal Gardens, Kew.—Five Lectures on Some Points in Vegetable Morphology; on Tuesday, April 30 to May 28.

LORD RAYLEIGH, M.A., F.R.S.—Four Lectures on Colour; on Thursdays, May 2 to 23.

Professor HENRY MORLEY.—Four Lectures on Richard Steele; on Saturdays, May 4, 11, 18, 25.

Rev. W. H. DALLINGER, F.R.M.S,—Three Lectures on Researches in Minute and Low Forms of Life; on Tuesdays, June 4, 11, 18.

Professer F. GUTHRIE, F.R.S.—Three Lectures on Studies in Molecular Physics; on Thursdays, May 30, June 6, and June 13.

JAMES SULLY, Esq.—Three Lectures on the Psychology of Art; on Saturdays, June 1, 8, 15.

Subscription to all these Courses, Two Guineas; to a Single Course, Half-a-Guinea.

The Friday Evening Meetings will be resumed on May 3rd, at 8 p.m. when Mr. Spottiswoode, Sec. R.I., will give a Discourse on "Polarised Light: a Nocturne in Black and Yellow," at 9 p.m. Succeeding Discourses will probably be given by Sir Wm. Thomson, Mr. A. Graham Bell, Professors Ramsay and Flower, Mr. Walter H. Pollock, and Professor Dewar.

In 8vo., price 21s., Illustrated.

CHEMISTRY.

By H. E. ROSCOE, F.R.S.,
AND
C. SCHORLEMMER, F.R.S.,
Professors of Chemistry in Owens College, Manchester.

Vol. I. The Non-Metallic Elements. With numerous Illustrations and Portrait of Dalton. [*Vol. II. in the Press.*

"We are struck with the number and the excellence of the illustrations, which in clearness and minute accuracy may be considered unrivalled. These merits belong not merely to the figures representing apparatus as employed in the laboratory, but to those explanatory of manufacturing plant on a large scale. . . . It is not too much to say . . . that the work may claim a place along with, and complementary of, the great systematic productions of Watts and of Gmelin, with the additional recommendation of being brought down to the most recent state of the science . . . an important feature—is that the work recognises no gulf between theory and practice, and deals with the chemistry of the factory as well as with the more refined operations of the laboratory. How great a boon this must prove to the student, and ultimately to the manufacturer and the nation, does not require to be further shown."—*Chemical News.*

"It appears to us to be by far the most useful systematic work on chemistry which has appeared since the publication of Graham's 'Elements of Chemistry.' The clearness of its style, the fulness of its information, the judgment which its authors have used in the arrangement of their facts, no less than its general accuracy, entitle this beautiful volume to the first place among the English text-books on chemistry."—*Manchester Courier.*

London: MACMILLAN and CO.

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester

Now ready, 8vo., cloth, 30s.

PHOTOGRAPHED SPECTRA. One Hundred and Thirty-six Photographs of Metallic, Gaseous, and other Spectra, printed by the permanent autotype process, with Introduction, Description of Plates, and Index; and with an extra plate of the Solar Spectrum (showing bright lines), compared with the Air Spectrum, by J. RAND CAPRON, F.R.A.S.

London: E. and F. N. SPON, 48, Charing Cross.
New York: 446, Broome Street.

Just published, 2nd Edition, 594 pp., 8vo., price 12s. 6d.

ORGANIC MATERIA MEDICA.
BY DR. MUTER.

Analytical Chemists will find this a concise and yet complete book of reference for the isolation and examination of the active principles of drugs. Special appendix on the microscopic characters of the starches in food and drugs. Copious index and qualitative courses for resins, &c.

Published by W. BAXTER at the Office of the South London School of Pharmacy, Kennington Cross, S.E., and sold by Messrs. Simpkin and Marshall and Messrs. Baillière, Tindal, and Cox.

Chemical Technology, or Chemistry in its Applications to the Arts and Manufactures. By THOMAS RICHARDSON and HENRY WATTS. Second Edition, illustrated ith numerous Wood Engravings.

Vol. I., Parts 1 and 2, price 36s., with more than 400 Illustrations.

Nature and Properties of Fuel: Secondary Products obtained from Fuel: Production of Light: Secondary Products of the Gas Manufacture.

Vol. I., Part 3, price 33s., with more than 300 Illustrations.

Sulphur and its Compounds: Acidimetry: Chlorine and its Bleaching Compounds: Soda, Potash Alkalimetry: Grease.

Vol. I., Part 4, price 21s., 300 Illustrations.

Aluminium and Sodium: Stannates, Tungstates, Chromates, and Silicates of Potash and Soda: Phosphorus, Borax: Nitre: Gun-Powder: Gun Cotton.

Vol. I., Part 5, price 36s.

Prussiate of Potash: Oxalic, Tartaric, and Citric Acids, and Appendices containing the latest information, and pecifications relating to the materials described in Parts 3 and 4.

BAILLIERE AND CO., 20, King William Street, Strand.

GLASGOW CORPORATION GAS.

RESIDUAL PRODUCT WORKS TO LET, AND RESIDUAL PRODUCTS FOR SALE.

The Glasgow Corporation Gas Commissioners are prepared to receive Offers for a Lease of their Residual Product Works at Dawsholm, near Maryhill, and also for the purchase of the Tar and Ammoniacal Liquor produced at their Gas Works there. The Lease to be for such term of years, from 1st June, 1878, as may be agreed on. Offerers must offer a fixed Rent of £1200 per annum, and also a further sum in respect of each Ton of Coal carbonised at the Dawsholm Gas Works. On application at the Gas Office (Manager's Department), 42, Virginia Street, intending Offerers will receive Orders for inspecting the Works. The Conditions of Let and Sale may be seen, and Forms of Offer obtained on application of the Subscriber, and Offers will be received by him up till Monday, the 22nd current.

The Commissioners do not undertake to accept the highest or any Offer.

J. D. MARWICK,
Clerk to the Commissioners.

City Chambers, Glasgow, April 2, 1878.

THE TELEPHONE.

Arrangements for Exhibiting or Fixing on application to EDWARD PATERSON, Telegraph Engineer, 3, Bedford Court, Covent Garden, W.C. Insulated Wires, Call-Bells, Insulators, and Galvanised Wire for Overhead Lines. Electric House-Bells, and all descriptions of Electrical Apparatus for experimental and other purposes. Price list post free 2 stamps.

ORIGINAL RESEARCH—ANNOUNCEMENT.

The long-sought for Governing Principles of Dr. Dalton's Doctrine of Definite, Reciprocal, and Multiple Proportions have been discovered; including a complete elucidation of the Governing Principles of the Substitution, Hydrogen-replacement, and Compound Radical Theories—Inorganic and Organic—of Modern Chemistry.

These discoveries are the result of eighteen years of Investigation and Research, and, entire success having been achieved, they are now brought forward complete in every sense of the word, and will prove an invaluable aid to the Student, the Teacher, the Lecturer, and the Practical Chemist, in every branch of the Science. Due notice of publication will be advertised.—"ERBERTMA."

Now ready, price 6d.,

EDISON'S
TALKING PHONOGRAPH

ITS CONSTRUCTION. ITS PRESENT CAPABILITIES.
ITS FUTURE POSSIBILITIES.

London: E. J. DAVEY, Boy Court, Ludgate Hill, E.C.
And at all Booksellers and Railway Stations.

Valuable Freehold Estate and Chemical Works, within one mile o the Tyne Docks, in the County of Durham. Total area, 67 acres.

MOSES PYE and SONS have been honoured with instructions to SELL BY AUCTION, at the Royal Turf Hotel, Newcastle, on Thursday, May 9th, at two for three o'clock

"THE LAKE CHEMICAL WORKS,"

South Shields, where the manufacture of soda-ash, refined alkali soda crystals, bleaching-powder, and the extraction of copper by the wet process, combined with the production of purple ore, have been successfully carried on.

The works occupy an area of five acres, with river frontage for shipment on the north, and nine acres directly opposite, leading up to the South Shields Branch of the North-Eastern Railway. Also

"BYLTON FARM,"

with all necessary farm buildings, arable and pasture-land, including a field with long river frontage, an excellent site for a manufactory Also

"BYLTON VILLA,"

with gardens, pleasure grounds, stables, coachhouses, coachman and gardener's houses, comprised in an area of three acres, in the occupation of G. D. Mease, Esq., the owner; and also

TWO SELF-CONTAINED DWELLING HOUSES

of ten rooms each, and Workmen's Houses.

The whole will be sold in one lot.

Plans and detailed particulars will be furnished on application to the AUCTIONEERS, 7, Collingwood Street, Newcastle, or to

Messrs. R. and R. F. KIDD, Solicitors,
43, Dean Street, Newcastle, and
113, Norfolk Street, North Shields.

THOMAS ADKINS & CO.,
SMETHWICK,
NEAR BIRMINGHAM.

MANUFACTURERS OF SPECIALLY PREPARED RED LEAD FOR FLINT-GLASS MAKING.

APPARATUS AND CHEMICALS
FOR USE IN
LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,
65, BARBICAN, LONDON, E.C.
MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal P ly-technic Institution.

THE CHEMICAL NEWS.

VOL. XXXVII. No. 961.

ON SOME CANDLES ALTERED BY LONG EXPOSURE TO SEA-WATER.

By J. H. GLADSTONE, Ph.D., F.R.S., Pres. C.S.

I AM indebted to Mr. Latimer Clark for some specimens of candles which are stated to have been recovered from the wreck of a Dutch vessel, sunk in Vigo Bay during the war in the year 1702. As the vessel was supposed to be a treasure ship many attempts have been made to recover its contents, and this was successfully accomplished in 1875, when these candles, among other things, were obtained. They have therefore been submerged for 173 years.

The wick has rotted away, leaving scarcely any trace of its existence, while the fatty portion has become a friable heavy substance, of a dull white colour. The candles bore evidence of having been made by dipping, for the concentric layers were easily separated from one another, and this facilitated the examination of the outer and inner portions of the same piece.

Both the outer and inner portions still contain some of the fat apparently unchanged; they are unctuous to the touch, and have a fatty odour, and when heated to a little below 110° C. they began to change colour; at 140° they softened, and at 200° small portions were melted out. This easily fusible matter dissolved readily in ether, and was almost white. Indeed the fat can be easily separated from the rest by treating the altered candles with ether and benzene, and in one experiment, made on 2 grms. of the candle, 0·879 grm. of fat, or 44 per cent of the whole, was thus dissolved out.

Pieces exposed to the heat of a lamp flame gave off combustible vapours, as might be expected, with the usual smell of burnt fat.

After complete combustion there remained a strongly alkaline white ash, consisting of carbonate and chloride of calcium and sodium, with traces of magnesium and potassium. The outer layers of one of the pieces, weighing 2·035 grms., yielded 0·147 of ash, or 7·2 per cent. The inner layers, weighing 2·262 grms., yielded 0·1907 grm., or 8·4 per cent. The chlorine in the first portion was estimated at 0·0266, and in the second at 0·0233: if this existed wholly as chloride of sodium it would indicate 2·15 and 1·70 per cent respectively; but as sea-water usually contains about 2·8 per cent of this salt, and the porous candles were no doubt saturated with sea-water, and allowed to dry in that condition, the chloride of sodium may be regarded as extraneous. The amount of calcium in the outer layers was found to be 0·053, and in the inner 0·0821: if this existed wholly as stearate of calcium ($C_{36}H_{70}CaO_4$) these figures would indicate 39·5 and 55 per cent respectively, but there seems also to have been present a certain amount of stearate of sodium. The excess of sodium in the inner portion beyond what was necessary to saturate the chlorine amounted to about 0·0098, indicating at least 5·76 per cent of stearate.

It thus appears that the fat has been converted in great measure into calcium and sodium salts, doubtless by the slow replacement of the triatomic group C_3H_5 in the stearine by 3 atoms of the metal, with the simultaneous production of glycerin.

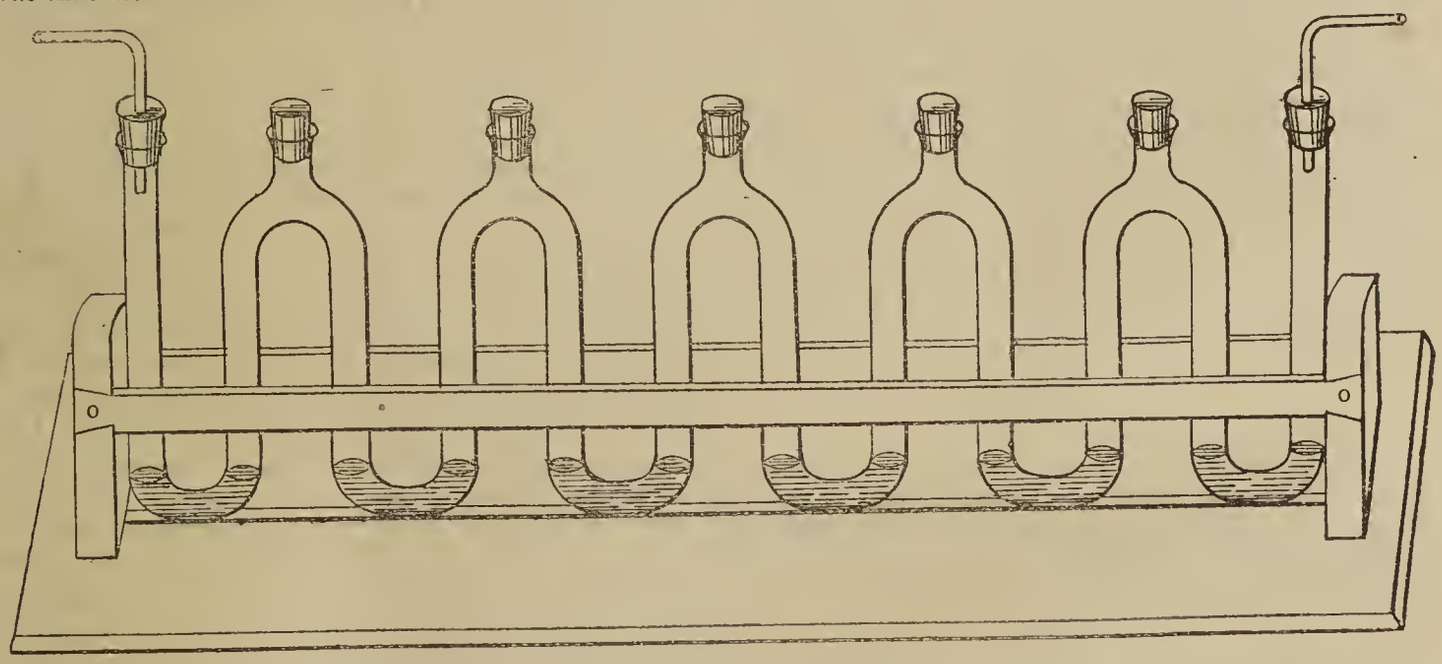
Though the calcium in sea-water is far less abundant than the sodium, it appears to have had a much greater effect; but it is, of course, impossible to say whether the one salt has not been made by double decomposition from the other.

The most interesting point, as it appears to me, is that whereas the fats have been in contact with a practically unlimited amount of sea-water for 173 years, and a chemical change between them has been possible, the double decomposition has proceeded so extremely slowly that the reaction is only about half completed at the present time.

A GAS-ABSORBER.

By G. GORE, LL.D, F.R.S.

EVERY chemist is well aware that by the single passage of a bubble or stream of gas through a liquid, the former touches only to a small extent the latter, and requires to be passed through several portions of the liquid in succession before it is completely absorbed or purified.



When either Woolf's bottles or bent glass tubes are employed for the purpose, in the former case a considerable bulk of liquid must be used, and in both cases a number of junctions must be made with the different parts of the apparatus, and a proportionate risk of leakage incurred. I have therefore constructed the apparatus shown by the annexed sketch, for the purpose of quickly saturating a small bulk of liquid with a gas, or speedily

absorbing a small quantity of gas by a liquid, without requiring many junctions to be made. It consists of a single glass tube, of about half an inch external diameter, bent into a series of four or six double curves, the upper part of each of which is provided with a neck (closed by an india-rubber bung), so that each limb of the tube may be readily cleaned. The tube is supported and kept steady in the manner shown in the sketch.

Having used the apparatus, and found it very effective and convenient for the intended purpose, and having been unable to find such an arrangement described in any catalogue of chemical apparatus, I have ventured to publish this description.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, April 18, 1878.

W. CROOKES, F.R.S., Vice-President, in the Chair.

AFTER the announcement of visitors, confirmation of minutes, &c., the following certificates were read for the first time:—H. R. Smith and J. H. Wilson.

The CHAIRMAN then called on W. A. TILDEN, D.Sc., to read a paper on "*Terpin and Terpinol.*" Terpinol is the name given by List to the liquid obtained by the action of dilute acids upon terpin hydrate: conflicting statements as to its composition and properties have been given by Wiggers, List, and Oppenheim. The author's experiments lead him to conclusions which differ materially from those made by the above chemists, and the author has brought this preliminary account before the Society although the subject is by no means complete. *Crystallised Terpin*, $C_{10}H_{20}O_2.OH_2$.—This compound was prepared by the process suggested by Wiggers. A mixture of 1 volume of nitric acid, 1 volume of methylated spirit, and 2½ volumes of rectified turpentine oil, is allowed to stand about two days: it is then poured into a dish, after the addition of a small quantity of methylated spirit. Terpin is deposited in successive crops of crystals. No crystalline compound is obtained from the terpenes of the orange group; but the same compound is obtained whether American or French turpentine oil be used. *Action of Dilute Hydrochloric Acid on Terpin.*—To 53·5 grms. terpin, boiled up with 700 to 800 c.c. water, 12 drops of hydrochloric acid are added, and the liquid distilled. An oily product, terpinol, distilled over between 205° and 215° unchanged; it has the formula $C_{10}H_{18}O$, and probable composition—

$$C_{10}H_{18}\begin{matrix}O\\O\end{matrix}C_{10}H_{18}.$$

It is a colourless, somewhat viscid liquid; sp. gr. at 16°, 0·9274. It has no action on polarised light. When dry hydrochloric acid gas is passed into it, its colour becomes purple, and ultimately a mass of crystals is formed, which by pressure can be obtained perfectly white. This new body has the composition—

$$C_{10}H_{18}\begin{Bmatrix}Cl\\Cl\end{Bmatrix}$$

and is therefore the dihydrochloride. If an alcoholic solution of terpinol be acidified with nitric acid, and the mixture placed in a dish, crystals of terpin are deposited. From this and other considerations the author concludes that, in the preparation of terpin by the ordinary process, terpinol is formed at a certain stage of the reaction. By the action of dilute sulphuric acid, 1 in 8, on terpin, and subsequent distillation in a current of steam, an oily product was obtained, which analysis indicated as a mixture of a hydrocarbon, $C_{10}H_{16}$, with terpinol. The crude product was therefore boiled for two to three hours with dilute sulphuric acid, 1 in 2, and distilled, finally from sodium: a liquid was thus obtained boiling at 176° to 178°, vapour density 68·8, with the formula $C_{10}H_{16}$, sp. gr. at 15°, 0·8526. It is optically inactive, gives no crystalline deposit with hydrochloric acid, and no crystalline nitroso-compound. A dibromide was prepared. The author suggests the name "terpinylene" for this hydrocarbon, which resembles in many respects the hydrocarbon characteristic of Russian turpentine oil. The author has made a preliminary examination of the oxidation products of terpinol and terpinylene.

After some remarks by Dr. ARMSTRONG the thanks of the Society were given to Dr. Tilden for his valuable paper.

Dr. ARMSTRONG then read a paper entitled "*The Poisonous Principle of Urechites suberecta*," by J. J. BOWREY. The *Urechites suberecta* is a common wild plant in Jamaica, where it is called Nightshade, from its well-known deadly properties. Its dark green leaves and large bright yellow flowers render it a conspicuous object. It is believed to have been frequently used as a poison by the negroes in former times, and occasionally its employment has been suspected at the present time. It is stated that by suitable doses it can be administered so as to produce death, either immediately or after the lapse of some weeks. Experiments by the author prove that this statement has some foundation. Three active substances have been obtained in a pure form—urechitin, urechitoxin, and amorphous urechitoxin. They are extracted from the leaves, which are physiologically more active than the other parts of the plant. The fresh leaves contain rather more than a half per cent of the active principle. Urechitin is prepared from the air-dried leaves by extracting with alcohol. By using this solvent in various states of dilution the pure substance was obtained in long four-sided prisms, transparent and colourless, containing 6 per cent of water of crystallisation, readily expelled at 100° C. Urechitin is practically insoluble in water and dilute alcohol; more soluble in ether, benzol, amylic alcohol, and strong spirit; and very soluble in hot alcohol, chloroform, and glacial acetic acid. Strong mineral acids decompose it. The reaction with hydrochloric acid proves the substance to be a glucoside. With strong sulphuric acid it gives a characteristic colour reaction. If 0·01 m.grm. be treated with a drop or two of strong sulphuric acid, a yellow solution is formed, which becomes successively orange, red, mauve, and finally purple. These changes of colour are much hastened by heat or the addition of a trace of some oxidising substances (nitrates, nitrites, chlorates, bleaching-powder, bromine, and iodine). The author prefers a trace of a solution made by adding one drop of nitric acid to 100 c.c. of sulphuric acid. The results of several analyses of different samples indicated the formula $C_{28}H_{42}O_8$. It is intensely poisonous and bitter, a solution of 1 in 40,000 having a distinctly bitter taste. Its solutions are also very acrid. Urechitoxin is prepared by a process somewhat similar to that used for obtaining urechitin, but the leaves are first dried completely at 100° C. Basic lead acetate is also used to precipitate the substance in question. It differs from urechitin in being much more prone to undergo change and become amorphous; it is more soluble in water, spirit, amylic alcohol, and chloroform, but less soluble in ether and benzol. It also crystallises less readily. With sulphuric acid it gives a colour reaction almost the same as that yielded by urechitin, and with hydrochloric acid splits up into an inert substance, urechitoxetin, and a body which readily reduces alkaline cupric solutions. Like urechitin, it is bitter, acrid, and exceedingly poisonous; 1-100th grain injected subcutaneously being sufficient to kill a cat within sixteen hours. From several concordant analyses the author deduces the formula $C_{13}H_{20}O_5$. Amorphous urechitoxin was procured as a residue in preparing urechitoxin, but has not been obtained in a pure state. In its toxic and general chemi-

cal properties it closely resembles the crystalline substance. Other substances have been obtained by the author, but to avoid confusion he has not named them, as their composition was not absolutely certain. In conclusion, he states that the poisonous properties of *Urechites suberecta* are mainly due to urechitin, which he obtained by the use of water, alcohol, and a temperature never exceeding 38° C., and that urechitoxin is a product of chemical change from urechitin. The author gives full details of the preparation, solubilities, chemical properties, &c., of the above substances. Specimens of the three bodies were exhibited, and the colour reaction shown at the meeting.

After the thanks of the Society had been given to the author for his interesting communication,

A paper by A. Wynter Blyth, entitled "*The Temperature at which some of the Alkaloids, &c., sublime, as determined by an Improved Method*," was read by Dr. Armstrong. Helwig was the first who systematically employed sublimation as a means of recognising the alkaloids, &c. Afterwards, Dr. Guy greatly improved the process. Very wide statements are, however, still made as to subliming-points—*e.g.*, theine, which really sublimes below 100° C., is said by Strauch to sublime at 177°, and by Mulder at 184·7° C. The author investigated the subject, and found these discrepancies to arise—(1) From defects in the apparatus used; (2) the want of a definition of the term "subiimate;" (3) the want of uniformity in general procedure. The method recommended by the author is as follows:—A porcelain crucible about 3 inches in diameter is nearly filled with mercury for low, or fusible metal for high temperatures. A very small quantity of the substance is then placed on a thin microscopical cover-glass, and floated on the fluid metal. The substance is then surrounded by a glass ring (cut from a tube) $\frac{1}{8}$ to $\frac{3}{8}$ in. thick, and covered by a second thin cover-glass. The crucible is supported by a brass plate fixed to a retort-stand, and covered by a flask from which the bottom has been removed. In the neck of the flask is a cork; through it a thermometer passes, which has its bulb immersed in the liquid bath of metal. A first rough determination is made, in which the bath is heated rapidly, and the upper cover-glass changed at every ten degrees. In a second experiment the disk is changed every four to five degrees. In the final determination the disk is renewed every half degree, the temperature being raised with great caution. The author defines a sublimate as the most minute films, dots, or crystals which can be observed by a quarter-inch objective, and which are obtained by keeping the subliming cell at a definite temperature for sixty seconds. The author has used the same apparatus without the upper cover-glass for determining melting-points accurately, the specimen being observed microscopically in order to determine when the first melted drops are formed. The active principles of plants can be classed (in regard to their behaviour to heat) for practical purposes into—(1) Those which give a decided crystalline sublimate; (*a*) below 100° C., *e.g.*, theine, thebeine, cantharidine; (*b*) between 100° and 150°; (*c*) 150° to 200°, pilocarpine, strychnine, morphine, &c. (2) Those which melt, but give no crystalline sublimate—(*a*) below 100°, hyoscyamine, atropine, &c.; (*b*) 100° to 150°, papaverine, &c.; (*c*) 150° to 200°, salicine, &c.; (*d*) above 200°, solanine, &c. (3) Those which neither melt nor give a crystalline sublimate, saponine, &c. In addition to the above substances the author has examined narcein, narcotin, delphinin, theobromine, picrotoxin, and quinidine, and gives details as to their behaviour when heated.

The Chairman suggested that more accurate results might be obtained by subliming *in vacuo*. He had found that oxalic acid sublimed without decomposition below 100° *in vacuo*.

The thanks of the meeting were given to Mr. Blyth, and the Society adjourned to May 2, when a lecture "On the Chemical Aspect of Vegetable Physiology," will be delivered by Sidney H. Vines.

NEWCASTLE-UPON-TYNE CHEMICAL SOCIETY.

Inaugural Address,

By John Affleck, M.A., D.Sc., President.

It is usually expected that the President for the year should append to his opening remarks a paper on some subject of original research. Not having anything of this nature to present to you, I shall content myself with offering a few observations on some of the more salient points in the alkali manufacture, and on some of the improvements that have been made or attempted in it within recent years; premising that, while I am conscious that many of my remarks may contain nothing novel or attractive to many of you, they are offered simply with the hope that they may not fail altogether in proving useful or suggestive to a few.

Sulphuric Acid.

In the sulphuric acid department there is no radica change, or even important improvement, either in plant or method of working, to be recorded within the last few years. And yet, undoubtedly, much progress is being made from year to year by improving the construction of the plant in a variety of details, by better burning of the pyrites, and by a better comprehension of how the course of the gases through the chambers ought to be regulated and controlled, so as to obtain the best results. In this way the results of chamber working have of late years been so much improved that it is not too much to say that, with a substantially built and ordinarily well-conducted plant, acid making is now the least troublesome and steadiest going department of an alkali works, while the loss of sulphur is being more and more reduced to a minimum.

Passing over the subject of the burning of pyrites, I shall limit the observations I have to make in this department to—

1. Glover towers;
2. Construction, capacity, and working of chambers, and the recovery and losses of nitre; and,
3. Calculation of acid productions.

1. *Glover Towers.*—Since the introduction of the Gay-Lussac tower in France in 1842, no improvement in the acid plant has proved so complete a success as these towers. First erected by Mr. Glover, on the Tyne, some ten or twelve years ago, to serve the double purpose of concentrating the chamber acid and denitrating the nitrous vitriol by utilising the waste heat of the kiln gases, they have now, at least in this country, supplanted all the previous costly and cumbersome methods of concentrating with fuel in pans, and denitrating in steam columns. And, at the present day, these towers are so universally employed that it would be hard to find a single acid plant without them.

The first towers put up on the Tyne were found to be too slimly constructed. So that, during the last few years, all prudent acid makers have been going in for more solid structures, both as regards foundations, timber-framing, and lead work. Side sheets are now very generally put in of 30 lbs. lead as far as the top of the burner pipe, bottoms and upstands 50 lbs. to 60 lbs. lead. Nor can I regard this as in any way a wasteful expenditure of material. On the contrary, it is clearly the wisest economy, if we consider the stoppage of work and the expense of emptying and repacking a tower, when its bottom gives way unexpectedly before the rest of it is much the worse. There is only one other point on this head to which I would direct your attention, and I regard it as of some importance. The temperature of the gases leaving the Glover towers to go to the chambers usually ranges, in my experience, from 140° to 170° F. Now this observation has led me to the conclusion that, as usually built, viz., from 25 feet to 30 feet high, and all the available space

filled with packing of flints or coke, the gases are too much cooled to obtain the greatest possible concentrating power. I consider in fact that, in such cases, the upper part of the tower *undoes*, to some extent, what has been done in the lower and hotter part. The steam evaporated from the acid in the lower and middle sections of the tower, and carried along by the hot gases in their passage upwards, is partly condensed again, when they have been cooled down below the boiling-point by the colder stream of acid they encounter near the top. And thus less concentration is effected than would be if the gases were allowed to escape from the tower at a temperature more approaching the boiling-point, or say 200° F. And this result would be equally produced by a too high, or too closely packed tower, the cooling effect on the gases being the same. Hence it follows that a tower might be made so high as to have practically no concentrating power at all, the gases being cooled at the outlet to near the temperature of the air, and the cold acid poured on at the top running away at the bottom *hot*, but not increased in strength. This view has been confirmed by the improved concentration, along with freer draught, obtained by working with short towers of about 18 feet in height, and by diminishing the packed space in higher ones, in various works in the neighbourhood.

2. *Chamber Construction, Capacity, &c.*—Regarding the fittest construction of acid chambers, the total capacity to be allowed to them for the work required, and the number and dimensions of the separate chambers into which that space should be sub-divided, on these points there still prevails the same wide diversity of opinion and practice. Though the work that a given chamber space may be forced to do is so elastic that no definite limit can be assigned to it, it is found in practice that, when chambers are pressed beyond a certain point arrived at by experience, the extra work done by no means compensates for the greatly increased wear and tear, and the larger percentage of nitre required for good condensation. Giving due regard to these considerations, it will be found to be wise economy in the long run to work with a large chamber capacity, by which I mean 3000 to 4000 cubic feet per weekly ton of pyrites. Not only will this result in a considerable saving of nitre, but the *total work* got out of the chambers will be greater than by driving them harder. To work chambers "high press" is only justifiable in certain emergencies, or in cases where it is a more important consideration to keep the capital expenditure low than to seek the greatest economy in working.

The numbers and dimensions of the chambers, found working together as a set, are very various. The single chamber, once so common in the earlier days of lead chambers, is still not unfrequently met with in some places, though, on the Tyne, I am not aware of any instance of it still surviving; and every number from that up to eight or nine working in a series is met with in practice. Chambers are built with lengths varying from 30 feet to 200 feet; breadths, from 20 feet to 50 feet; and heights, from 9 feet to 33 feet. The latter very unusual height has, I notice, been adopted at Stolberg, in Germany.

The theory has been held and defended by some, that the formation of acid is promoted by the surface action of the sides of the chambers, and that therefore we ought to go to the expense of making our chambers very low and narrow, in fact, more like tunnels. I do not know, however, any practical man who now countenances this view. The experiments which appeared at first sight to support it have been shown by some German chemists to be thoroughly fallacious. Neither, on the other hand, can we admit unconditionally that with gases of the same composition and under the same physical conditions of temperature and pressure the acid formed will be simply proportional to the total chamber space, however that may be apportioned. If we could imagine acid making to be conducted in an intermittent fashion (as, I believe, actually took place during the first and most primitive stage in its history), filling a given space with successive portions of the mixed gases, and leaving them at rest till complete condensation, although, under these conditions, this might at first sight appear to be the case, still, even then the form of the condensing space would be found not wholly immaterial. One spherical chamber, or the nearest practical approach to it, say, a cubical chamber, would then, in my opinion, be at once the most economical and the most effective condensing space, because in it the diffusion of the stagnant gases would be least impeded, and the gaseous currents due to condensation would most rapidly effect that complete intermixture of the component gases required for the condensation of the last portions of the sulphurous acid.

But acid making being a continuous process, the gases constantly entering and leaving the chambers, we have to consider in what way this will affect the condensing or acid-forming power of a given space, according to its form. Now, I think we may compare the reactions going on during the passage of the gases through the chambers to the case of one metal precipitating another out of solution; as, for instance, iron and copper in the usual process of copper extraction. In some instances, the liquors containing the copper in solution used to be run continuously through a series of four or more vats filled with scrap iron, depositing their copper completely before running away to waste from the last. This I consider is very analogous to what takes place with the gases of the acid chambers, the copper representing the sulphurous acid, the iron the nitric oxide (N_2O_2) and oxygen, and the waste liquors the residual oxygen and nitrogen gases passing away by the chamber exit. In the first two vats through which the liquor passes strongly impregnated with copper the precipitation goes on very rapidly, but on the bulk of the copper being separated it gets very sluggish, and the liquor requires to traverse several more vats, and to be thoroughly mixed by entering below and overflowing at the top, in order to give the iron time to come into contact with, and precipitate the last traces of copper from the large bulk of waste liquors.

The chamber process may be described in almost identical terms. The gases from the kilns enter the chambers comparatively rich in sulphurous acid, and the production of sulphuric acid by their combination goes on very rapidly. The heat they bring with them and that developed by the chemical action produce an intense molecular activity in the gaseous mixture, and the condensation taking place gives rise to gaseous currents, which alone are sufficient to mix the gases thoroughly. Therefore, at this stage, the production of acid goes on as well in the largest as in the smallest chamber; but with this important difference in favour of the larger chamber, that there is less contact of the gas with the lead per unit of gaseous volume contained in it, and therefore less wear and tear of lead per ton of acid made. But, in the chambers, just as in the copper precipitating vats, the energy of the action abates as the acid is deposited on the floor, the heat and molecular activity of the gases diminish, and when two-thirds, or thereabouts, of the acid has been separated, it is then beneficial to further mechanically the complete mixing of the residual gas by filtering it, so to speak, through three or four smaller chambers. In this way, the remaining attenuated particles of sulphurous acid, forming now only one or two per cent of the whole bulk of gases, by being made to pass out of one chamber into another, are forced to come into intimate contact with the excess of oxygen and nitric oxide, and so oxidised and precipitated from the mass of inert gases.

But though these considerations should dissuade the acid maker from simply constructing the largest chamber space out of the least possible materials, it is nevertheless a very important point for him to consider to what extent he may save lead without impairing the efficiency of his plant. This end will be best attained, I think, by forming the first portion (say one-half or two-thirds) of the chamber

space into two chambers of large capacity, constructed with as much economy of material as possible, and the remainder into three or four much smaller chambers with the view of facilitating complete condensation along with economy of nitre.

On the Tyne chambers will be often found with one-fourth of a square foot of lead for every cubic foot of capacity. This might just as well be reduced to one-fifth of a square foot; with, first, as good working results; second, less wear and tear of lead; and, third, a saving of one-fifth of the whole lead.

Say, for instance, we had to build a set of chambers to take 70 tons of pyrites per week—a very handy size in a large acid plant. Allowing a liberal working capacity of 3200 cubic feet per weekly ton, I would divide the total chamber space somewhat in this fashion into six unequally sized chambers, say:—

2 chambers, each 60'0" long × 50'0" broad × 20'0" high, and
4 " " 60'0" " × 20'0" " × 20'0" "

giving a total capacity of 216,000 cubic feet, with a total superficial area of 43,200 square feet of lead; or equal to one-fifth square foot of lead per cubic foot capacity. This arrangement of the space would therefore require on the whole 10,800 square feet less lead than the same capacity of chambers constructed with one-fourth square foot of lead per cubic foot capacity. At 7 lbs. to the foot, this would amount to nearly 34 tons of lead, a very considerable item. It might be worth consideration whether the lead thus saved in the superficial measurement might not be expended advantageously in increasing the weight per square foot by one-fourth, which would probably make the life of the chambers at least one-half longer.

I think it is a good thing to keep the chambers rather short, not exceeding 80 feet to 90 feet, in order to apply the steam at shorter intervals in the course of the gas, and thus keep the acid of more uniform strength from one end of the chamber to the other; and also with the view of being better able to control the strength of the acid formed, more especially at those critical points of the series where a too great increase in strength causes it to absorb nitrous gas, and carry it down out of the circulation. When the chambers are very long one or more steam jets must be placed along the side in addition to the one at the end. Otherwise, it will be necessary to keep the acid far too weak at the steam end, in order to prevent its getting so strong at the far end as to become destructive to the lead, or to absorb nitrous gas. There is the same inconvenience in using jets of spray or "pulverised water," as Sprengel's patent recommends to be done. Spray has not the "carrying power" of steam, and would therefore need to be applied in frequent jets along the sides of the chambers—the objections to which are clearly greater than any trifling saving in fuel that may be effected by using only so much steam as is necessary to produce the jets of spray. It appears to me that the best results will be obtained by forming chambers into sets of not less than *five* or *six* in number, the gas passing through all the chambers in succession; and that, to secure the steadiest working and the most complete condensation possible the number may be advantageously increased to *seven* or *eight*. Any chance deficiency in the supply of steam or nitre can then be more easily corrected in time to prevent it affecting the colour of the gases at the exit. Twin sets of chambers are also to be recommended. In this case the gases from two sets of burners pass first through, say, two chambers each, and then jointly through three or four more chambers common to both. By this arrangement the irregularities incidental to working tend to compensate each other.

I do not intend to say much on the rather vexed question of the gaseous reactions going on in the chambers. Working in the usual way with pyrites, as on the Tyne, the gases from the kilns will enter the chambers having about the following composition by volume:—

Sulphurous acid	7·0 per cent
Oxygen	11·5 "
Nitrogen	81·5

It is well known that when these gases meet with steam and nitric acid in the Glover towers and chambers sulphuric acid is produced, and an oxide of nitrogen liberated; which, recovered by absorption in strong sulphuric acid, can be used over again, producing the same effect as the original nitric acid liberated from the nitre. It is also agreed in a general way that this is really effected by the nitric oxide (N_2O_2) taking up oxygen to form a higher oxide, and passing it over in successive portions to the sulphurous acid. But in formulating the exact course of the reactions there is a great diversity of views held by chemists, hinging upon the different oxides of nitrogen which may be represented as taking part in the operation. The chief of these theories may be stated as follows:—

1st Theory.—The immediate agent in the oxidation of the sulphurous acid is to be regarded as nitric acid itself (HNO_3). This acting on the sulphurous acid forms sulphuric acid and peroxide of nitrogen, according to the equation $SO_2+2HNO_3=H_2SO_4+N_2O_4$. The latter is decomposed by the steam into nitric (HNO_3), which acts as before, and nitrous anhydride (N_2O_3), which in its turn is decomposed by steam into nitric acid and nitric oxide (N_2O_2); and the nitric oxide then takes up oxygen from the air present, to reform peroxide of nitrogen (N_2O_4), as represented in the equations—

$$2N_2O_4+H_2O=2HNO_3+N_2O_3.$$
$$2N_2O_3+H_2O=2HNO_3+N_2O_2.$$
$$N_2O_2+O_2 \quad =N_2O_4.$$

2nd Theory.—According to this theory, the reactions going on in the chambers are still more complex, and marked by the formation and immediate decomposition of a peculiar compound or nitro-substitution product of sulphuric acid, commonly known as the "white crystals of the chamber." The steps are represented as follows:—

Nitric acid acting on the sulphurous acid gives, as in the first theory, sulphuric acid and nitrogen peroxide (N_2O_4). The N_2O_4, thus liberated by the first action of the SO_2 on the nitric acid carried into the chamber in the first instance, then becomes the active agent in oxidising further quantities of SO_2. This is owing to its peculiar property of forming by union with SO_2 the crystalline compound just mentioned, which may be represented as $SO_2.NO_2.NO_2$, or sulphuric acid in which the two hydroxyls are replaced by two atoms of NO_2. As according with its mode of decomposition this body is more commonly written $SO_3.N_2O_3$; and, if combined with one atom of sulphuric acid (as it is usually supposed to be in the free state), it will be represented either according to the radical theory as $SO_2.HO.NO_2$, or dualistically as $H_2SO_4,SO_3N_2O_3$. If steam were deficient, the reaction would end with the formation of this body; and with only strong acid lying on the chamber floor it would on falling be dissolved in it, forming what is known as "nitrous sulphuric acid." This, as is well known, actually occurs when there is a deficiency of steam in the chambers. But under normal conditions, with excess of steam present, it is at once decomposed according to the equation $SO_2.NO_2.NO_2+H_2O=SO_2.HO.HO+N_2O_3$. The nitrous anhydride (N_2O_3) set free by the decomposition, in oxidising a further portion of sulphurous acid is reduced to nitric oxide (N_2O_2), which, being again oxidised to N_2O_4 by the excess of oxygen present, is ready to start again with the formation of the crystalline compound.

3rd Theory.—This theory represents the whole operation in a much simpler and, to my mind, more natural manner. Nitric acid and steam acted on by excess of sulphurous acid produce at once sulphuric acid and nitric oxide, $3SO_2+2HNO_3+2H_2O=3H_2SO_4+N_2O_2$. Nitric oxide ($N_2O_2$) is then oxidised in varying proportions into nitrous anhydride (N_2O_3) and nitric peroxide (N_2O_4), according to the greater or less excess of oxygen present in the chamber. And both of these oxides react in a similar way to nitric acid on the sulphurous acid, producing, by the help of steam, sulphuric acid and nitric oxide as before.

4th Theory.—According to this theory, only nitrous anhydride (N_2O_3) is produced even by excess of oxygen acting on nitric oxide (N_2O_2) in presence of sulphuric acid. This last is Weber's theory, and seems to be supported by direct experiments.

Without attempting to decide which of these rival theories is most in accordance with the phenomena observed, I shall pass on and notice two questions in connection with these nitrous compounds which have a practical interest, and would form a very interesting subject for a good chemical paper by some of our members.

The first regards the relative value and accuracy of the various methods employed to determine the nitrate of soda equivalent to the oxides of nitrogen in "nitrous sulphuric acid."

Various chemists have investigated this question, and a good deal has been written and published on the subject from time to time. But still none of the methods usually employed are, in my opinion, above suspicion, and more thorough investigation is required before we can attain the requisite certainty in stating the value of a sample of nitrous vitriol in terms of nitrate of soda. In a paper recently communicated to the Newcastle Chemical Society, Dr. Lunge, of Zurich, has taken up this subject. By using an artificial "nitrous vitriol," produced by dissolving pure nitrite of silver in pure concentrated sulphuric acid of 1·84 sp. gr., and proved to be free from nitrogen compounds, he has shown that very accurate results may be got by the permanganate method, if the usual course is adopted of running the nitrous vitriol from the burette into a measured quantity of permanganate, so as to oxidise the nitrogen compound immediately on its coming in contact with water. If, on the other hand, a measured quantity of the nitrous vitriol is taken, and the standard permanganate run into it, there is always a portion of the N_2O_3 that escapes oxidation by splitting up with the water of the test solution into nitric oxide (which escapes) and nitric acid, before it can be acted on by the permanganate.

No doubt the other oxidising agents that have been used by different chemists for this purpose, such as bichromate of potash, chloride of lime, and hypochlorite of soda, would give equally accurate results in these circumstances. But in proceeding to apply this process, without further concern, to the determination of the nitre equivalent contained in the nitrous vitriol usually obtained in the working of acid chambers, it seems to me that Dr. Lunge has overlooked the sole difficulty of the problem. This I have always regarded as arising from the fact that in ordinary "nitrous acid" we have neither *pure* sulphuric acid, nor, so far as we know for certain, *pure* nitrous anhydride (N_2O_3), as is usually taken for granted. With the exception of the small quantity made from sulphur, nearly the whole of our acid is made from arseniferous pyrites. It is therefore more or less impregnated with arsenic, which so far as it exists in the form of arsenious acid, will affect the titration with an oxidising agent. Then, we are not perfectly sure that there may not be some nitric peroxide (N_2O_4), as well as nitrous anhydride (N_2O_3), escaping from the chambers, and absorbed in our Gay-Lussac acid as such. In fact Winkler has stated, as the results of his experiments, that the former oxide of nitrogen is dissolved by sulphuric acid, though the combination is not nearly so stable as that with N_2O_3; so that, until it is conclusively proved that N_2O_3 is the only absorbable oxide of nitrogen leaving the chambers, this must be another source of fallacy in testing nitrous vitriol by any method based upon the quantity of oxygen required for oxidation. For these reasons it is desirable, I think, to test in some other way the accuracy of these methods in order to ascertain whether, and how far, the results given by them are affected by the causes to which I have referred. This might be done, either by the *ammonia* method, as variously conducted by Schulze, Harcourt, and others, or better, perhaps, by Schlösing's *nitric oxide* method, viz., after oxidising the nitrous vitriol with permanganate, reducing the nitric acid formed, by means of a ferrous salt, to nitric oxide, re-oxidising the nitric oxide over mercury, by means of oxygen and water, to nitric acid, and titrating the latter with standard alkali solution. I should prefer a modification of the latter method adopted by various chemists, which consists in directly measuring the nitric oxide, either over mercury or over concentrated caustic soda solution. Several chemists have, indeed, reported unfavourably of the ammonia method, as not effecting in every case a complete conversion of the nitric acid into NH_3. Dr. Lunge, among the rest, has found, on trying it with both pure nitrates and pure nitrites, that it gave him results falling short of the truth by a large amount. On the other hand, many chemists of repute have declared that the method gives extremely accurate results if conducted with the necessary precautions.

The second question relates to the sources of the loss of nitre in the process. It appears to be well established, by the investigations of various chemists, that there is a partial reduction of nitric oxide in the hot gases of the kilns to nitrous oxide (N_2O), or more probably to nitrogen. Now it would be extremely interesting to know whether and how far this is an invariable source of loss, in the usual way of working, where the hot kiln gases are used to carry the nitrogen compounds into the chambers, or whether it takes place only under certain conditions of heat and concentration of the gases. After answering the first question, and so establishing a thoroughly trustworthy method of valuing "nitrous acid," the loss from this source could be determined most easily in an indirect way, by finding the amounts of nitre lost in the acid run away and in the waste gases, calculating the percentage on the sulphur used, and deducting from the actual percentage of nitre required.

I have little doubt, however, that the loss of nitre in this way is small compared with that due to the imperfect absorption at the outlet of the chambers. It is a well known fact that, even when chambers are in the very best order and working with the usual percentage of nitre, the waste gases appear yellowish in bulk. This is simply because the available packed space in the Gay-Lussac tower is not sufficiently large to search out and absorb all the nitrous gas, in so short a time, from the vast bulk of the diluting gases passing through it. In nearly every instance these towers are built far too small for anything like perfect absorption. It is my experience that, by largely increasing the absorbing space, there is almost no limit to the reduction in nitre that may be effected. Most towers would require to be at least doubled in horizontal area. And if only one-half per cent nitre on pyrites were saved by the operation, it would defray the whole extra cost of the larger tower in one or two years. To make the recovery of nitre as complete as it might be, I think the absorbing space in the Gay-Lussac towers should not be less than 80 to 100 cubic feet per weekly ton of pyrites; and under these circumstances, with a chamber working space of 3000 to 4000 cubic feet, I should expect to work with ¾ per cent to 1 per cent of nitre on the pyrites. While maintaining the height of the tower as at present—aboubt 40 feet to 50 feet—I would add the additional capacity in increased horizontal section, with the further advantage that the coke packing might then be made closer without running the risk of choking the draught.

It has recently been proposed to feed the chambers with nitre in solution, through the Glover tower, or otherwise. This forms the subject of Burnard's patent, though I may mention that the plan was tried five or six years ago, at the Jarrow Works, by Mr. Hill, and abandoned. If otherwise free from objections, it would certainly be a much more regular way of supplying the nitrous compounds; and besides doing away with the unpleasant job of "potting," would avoid the possible loss of nitre by the reduction proceeding too far in the hot kiln gases. But, unfortunately for the success of this would-be improvement on the old way of working, the sulphate of soda thus formed in the acid of the towers crystallises out in the

pipes and cisterns, if it is allowed to cool, and chokes them up. And even if the quantity is not great enough to produce that effect, acid so impregnated with sulphate of soda could not be used for the Gay-Lussac very long without silting up the pores of the coke. This difficulty may, of course, be got over in some measure by keeping one Glover tower fed with the nitre solution alone, and running the hot acid direct from it to the decomposing pans, while another Glover tower, fed only with nitrous vitriol, concentrates acid for the use of the absorber. But this is a restriction on the freedom of working that would often be very inconvenient, and in a small plant, with only one Glover tower, quite impossible. To meet this difficulty the patentee has devised a sort of injector, to carry the mixed acid and nitre solution, by means of a jet of steam, into the first chamber in the form of a *spray*. I learn, from Mr. Rennoldson, who has tried this arrangement at the Tyne Alkali Works, that it was very difficult to adjust the steam-jet so as to convert the liquids into a complete spray, and ensure the nitre remaining long enough suspended in the atmosphere of the chamber to be completely decomposed before falling into the bottom acid. He also found that so much steam was required for the purpose that, together with the steam evaporated from the tower and the water from the nitre solution, the acid of the first chamber got far too weak for use. The patentee claims by this method to have reduced nitre to about 1 per cent on pyrites.

(To be continued.)

NOTICES OF BOOKS.

Artificial Manures; How to Make, Buy, Value, and Use. By Alfred Sibson, F.C.S. London: W. Ridgway.

This work is addressed not to chemists, scarcely to manufacturers of manure in the ordinary sense of the word, but to agents, merchants, and above all to consumers. There are indeed here and there a few hints which may be of value to the analyst; there are tabular views of the average composition of coprolites and other phosphatic minerals, and there are formulæ for the manufacture of mineral superphosphate (in which, by an unfortunate misprint, Cambridge coprolite is stated to contain 5—8 per cent of tribasic phosphate of lime, instead of 58) of bone-manures, bone-ash superphosphate, &c., which will doubtless prove useful to amateur makers and farmers, who mix manures for their own consumption, or perhaps supply a few neighbours. But this practice the author is far from recommending. He points out very justly that the raw materials are quite as likely to be sophisticated as the finished manure, and that the manufacturer's profit depends to a very great extent upon the purchase of phosphatic minerals, &c., on the large scale, upon the production of the acid required, and the use of steam-power in various departments of the process.

Into the valuation of manures the author enters at some length. He considers, indeed, that the consumer or the merchant ought themselves, on receiving the analysis of a sample, to calculate its approximate value, without having recourse to the chemist. So long, however, as the latter is expected to perform this task, he should, at least, bring correct principles to the task. He therefore gives the following scale of prices per unit:—

Soluble phosphate, 4s. 6d.; do. in mineral superphosphate, 4s.; precipitated phosphate, 3s. 6d.; insoluble phosphate of bones or guano, 2s. 6d.; do. mineral, up to 7 per cent, 1s.; potash sulphate, 3s. 6d.; and ammonia, £1.

It is obvious, however, that in valuing manures, a double standard may be applied. There is the strictly agricultural value; the question how much benefit 10 or 20 per cent of any given constituent will bring to the soil; and, on the other hand, the commercial value, the cost of its production. The former of these values is necessarily fixed, since the power of potash, or ammonia, or phosphoric acid in nourishing any particular crop must remain the same whatever may be its market price. The latter, or the commercial value, obviously depends on supply and demand. How these two values may be relatively altered is well seen in the case of peruvian guano. This manure, in its palmy days, as Mr. Sibson shows, contained from 16 to 18 per cent of ammonia, whilst now it has fallen to about 10 or 11, whilst its moisture and its insoluble siliceous matter have undergone a corresponding increase. Its agricultural value has evidently, therefore, fallen, whilst its commercial value has undergone no corresponding change. Formerly it was valued by chemists at more than its selling price, whilst now it is estimated, and less, and is hence evidently a much worse bargain for the farmer than was the case thirty years ago. Mr. Sibson evidently aims at giving the commercial value, since he says: "the following scale is intended to apply to the purchase of manures under the circumstances usually prevailing in agricultural districts where they are supplied in bags, carriage paid, and credit given." Yet he ascribes a lower value to "precipitated" (reduced, or reverted) phosphate than to soluble, though the former must obviously have cost as much in its preparation as the latter. It will be perceived that a higher value per unit is set upon soluble phosphate from recent organic sources than upon that prepared from mineral sources. Yet on p. 42 we read that the soluble phosphate derived from mineral phosphates "is in every respect as good as that obtained from bones." A peculiarity in Mr. Sibson's scale of values is the comparatively low estimate placed upon soluble phosphate. It has been valued by various authorities at £30 to £32 per ton—a more convenient system in our opinion than that of prices per unit. We refer to these points to show the great difficulty involved in attempting to fix upon manures a money value, which shall be satisfactory from every point of view.

The author, we are glad to find does not countenance the delusion—still too widely prevalent—that the profits of the manure-maker are exorbitant. Whatever may have been the case "once upon a time" the competition in the trade permits of no high scale of emoluments, and few departments of business require so much capital, skill, judgment, and energy in proportion to the sums realised. Some instances of adulterated manures are given in the book before us, but it is not intimated that such cases are increasing. Indeed, as far as we have been able to observe, the very contrary is the fact.

To those classes of readers for whom it is more particularly intended Mr. Sibson's work will doubless prove of considerable utility.

*Beer; its Adulterations, and the Means for their Detection.** By Dr. R. Stierlin. Bern: E. Magron.

We have here a very thorough-going and carefully-compiled manual. The author first gives an account of the four normal ingredients used in brewing, to wit, malt, hops, water, and yeast, and protests against all additions and substitutes. He next enters upon the chemistry of fermentation and the practice of brewing. We perceive here that he is not unacquainted with the tricks of the trade. Thus he mentions the English custom of adding salt to malt-liquors for the purpose of increasing the thirst of the drinker, and informs us that in East Prussia *Comarum palustre* is added with the same questionable intent. He points out that the pipes, taps, &c., of the beer-pumps used in taverns are attacked by the liquor, and recommends that the former should be made of pure tin, free from lead, whilst the taps should be coated in-

* Das Bier, seine Verfälschungen, und die Mittel selcke nachzuweisen.

wardly with nickel, which is proof against the dilute vegetable acids present in beer. The possible sophistications of malt-liquors—a very formidable catalogue—are next enumerated, and methods for their detection laid down. Dr. Stierlin premises the very useful caution that beer which has produced unpleasant symptoms in the consumer must not necessarily be supposed to contain poisonous adulterations. If the process of fermentation has failed, or if the liquor is turning sour it may, especially if taken in excess upon an empty stomach, exert a decidedly poisonous action. For proving the physiological action of substances separated out in the course of the analysis, he recommends mice, "for which we need entertain no especial compassion if the experiment succeeds and the subject perishes, and which offer the advantage that the substance in question can be easily recovered from the intestines and from the urine."

The action of any organic base upon the pupil of the eye he ascertains by experiments upon cats. These recommendations, however, are of little value to English chemists, since, according to the peculiar logic of hysterical humanitarianism, they would amount to the sin of vivisection. To give a mouse poison simply for its destruction or for amusement is lawful, but to administer to such an animal a dose of an unknown or doubtful substance, in order to ascertain its nature, is a serious offence without the operator has obtained a special licence from the Home Secretary. Were not inconsistency one of our most cherished national attributes, we should not tolerate an action perpetrated out of pure wantonness, and yet punish it as a crime if performed with a high and important motive. Dr. Stierlin's method consists of the following operations:—Determination of the specific gravity of the carbonic acid (upon which he places only a secondary value), of the alcohol, and of accompanying volatile acid. Determination of gluten, of total solids; of the ash, and of its silicic, phosphoric, and sulphuric acids; of its other constituents. Special examination for injurious metals. Resolution of the extract and search for foreign bitters and alkaloids. Finally, he examines the colouring matters both chemically and spectroscopically.

Such an examination must naturally consume much time, and can only be entrusted to an experienced chemist, but it is idle to expect that all the possible impurities of so complex a fluid can be discovered by a few simple tests.

The most interesting portion of the work consists of the instructions for the detection of substitutes for hops. The author treats the residue obtained on evaporation, first with an acid, and then with ammonia, and subdivides the two portions thus obtained by successive treatment with petroleum ether, benzin chloroform, and metallic alcohol.

The author doubts the alleged use of strychnia as an adulterant of beer, since to impart perceptible bitterness to a litre 0·005 to 0·01 grm. would be required, a very serious dose, especially as the alkaloid would combine with the free acetic acid always present in beer, in which state much of its original bitterness is lost.

Aloes, the use of which, according to Peter Pindar, was suggested by George III., should be sought for not in the beer itself, but in the sediment at the bottom of the cask.

An appendix contains an account of Pasteur's proposed method for excluding from beer during fermentation the germs of all other fungi save the true *Mycoderma vini*, and thus obviating most of the morbid changes to which malt liquors are subject.

We must pronounce Dr. Stierlin's treatise a most valuable addition to the literature of chemistry as applied to food and its adulterations.

It ought to be in the hands of every public analyst and medical officer of health, as well as of every person who is studying the art of brewing.

CORRESPONDENCE.

SPONTANEOUS METAL-GROWTH.

To the Editor of the Chemical News.

Sir,—About twelve years ago I put about an ounce of rolled metallic cadmium (coiled six times) into a clear flint-glass phial, corked it tightly, cut the cork level with the mouth of the phial, and sealed it very carefully. At the time the metal did not quite reach up to the neck of the phial. Since that time it has elongated more than a quarter of an inch, and, during the present year, the sealing-wax has been broken all round and the cork forced outward more than one-eighth of an inch. The cork is even now fairly tight, but the metal follows after it to touching forcibly, and probably the cork will be presently completely forced out.

The cadmium is fast oxidising and endeavouring to uncoil itself, and the cut edges at the bottom of the phial are becoming foliated.

Allow me to ask if your readers have noticed any such spontaneous change in this metal.—I am, &c.,

T. A. Readwin.

Liverpool, April 19, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Berichte der Deutschen Chemischen Gesellschaft, No. 19, December 10, 1877.

Determination of Vapour-Densities.—V. Meyer.—The author describes a greatly simplified apparatus for these determinations, which is essentially the same as that lately described by him to be used with Wood's metal, the latter being replaced, however, by mercury, and the sulphur vapours by those of water, aniline, or ethyl-benzoate. A U-tube, open at one end, contains the substance to be experimented upon, and is filled with mercury. It is then hung in an atmosphere consisting of the vapours of one of the above-mentioned liquids until the mercury ceases to flow out. The weight of the mercury which has been ejected the height of the mercury column in the side tube, temperature, and pressure supply the necessary data for determining the density.

Vapour-Densities of Reten, Fluoren, Stilben, and Chrysen.—W. Knecht.—The author has determined the vapour-densities of these substances by means of V. Meyer's apparatus (with Wood's metal), and obtained results coinciding with the formulæ accepted at present.

Introduction of Nitrogen Radicals into Compounds of the Fatty Series.—V. Meyer.—Diazo-benzene-nitrate, when added to a solution of aceto-acetic-ether in HKO, gives rise to a bright yellow compound melting at 154°, possessing the properties of an acid, and forming yellow finely-crystallised salts. The reaction is—

$$C_6H_5.N_2.NO_3 + CH_3.CO.CHK.COOC_2H_5 + H_2O = KNO_3 + C_2H_5OH + C_6H_5.N_2.CH(COOH).CO.CH_3.$$

This compound is one of the rare instances of the formation of an azo body in the fatty series. A solution of aceto-acetic-ether in caustic potash, when treated with KNO_2 and H_2SO_4, yields at once a new acid,—

$$C_6H_9O_4N, C_6H_{10}O_3 + HNO_2 = H_2O + C_6H_9O_4N.$$

It is a transparent oil, neither miscible with water nor capable of distillation, dissolving in alkalies with a deep yellow colour, and is probably a nitroso-derivative.

Dimethyl-aniline.—W. Michler and A. Gradmann.—Dimethyl-aniline, on treatment with benzyl-chloride, yields dimethyl-phenyl-benzyl-ammonium-chloride,—

$$NCl(CH_3)_2(C_6H_5)(CH_2.C_6H_5).$$

At 220° it changes into the hydrochlorate of the base, $N(CH_3)_2(C_6H_4.CH_2.C_6H_5)$, which is separated on treatment with Ag_2SO_4, and which yields dimethyl-aniline and benzyl-alcohol by dry distillation.

Dimethyl-amido-phenyl-glyoxalic Acid.—W. Michler and U. Hanhandt.—The authors have obtained this acid, $C_6H_4[N(CH_3)_2]CO.COOH$, by the action of dimethyl-aniline on the chloride of ethyl-oxalic acid,—

$$COCl.COOC_2H_5,$$

and saponification of the resultant ether. The ether forms small yellow laminæ, melting at 95°. The acid is similar in appearance, melts at 187°, is soluble in water, and forms crystalline salts. By this method the keton-acids of the aromatic series can be obtained, but in a manner less preferable than that lately discovered by Claisen and by Hübner.

Normal Nitro-butan.—J. Züblin.—The author has made a very complete study of this body, and finds that it possesses the same general properties as the other primary nitro compounds. It is obtained by the action of $AgNO_2$ on normal butyl-iodide as a colourless liquid, lighter than water, boiling at 151°, and possessing slight acid properties. Reduction changes it into normal butyl-amine, the hydrochlorate of which reduces alkaline solutions of Cu, Ag, and Hg salts with great ease. By heating with HCl it yields hydroxylamine and normal butyric acid. With HNO_2 it gives rise to butyl-nitrolic acid, a yellow oil dissolving in alkalies with a bright red colour. Treatment with Br, according to Tcherniac's method, yielded the mono-bromo-derivative, and, according to Myer's method, the dibromo-derivative. The mono-bromo-nitro-butan is a heavy yellow oil, and is changed into dinitro-butan, $C_3H_7.CH(NO_2)_2$, when exposed to the action of HKO and KNO_2. This is likewise a yellow oil, boiling at 190°, and forming crystalline salts with K and Ag, $C_3H_7.CAg(NO_2)_2$. It forms also a mono-bromo-derivative.

Iso-nitro-butan.—A number of derivatives isomeric with the above-mentioned are described. The mono-bromo compound boils at 175°. Iso-dinitro-butan is a yellow oil decomposed on heating. Its potassium salt, $(CH_3)_2CH.CK(NO_2)_2$, gives with bromine-water iso-mono-bromo-dinitro-butan, a colourless mass resembling camphor, and melting at 38°. This salt, in solution with diazo-benzene-nitrate, forms iso-nitro-butyl-azo-phenol, $C_6H_5N..N.CH(NO_2).CH(CH_3)_2$, a yellow oil.

Dichlor-anilines.—F. Beilstein and A. Kurbatow.—Of the six possible isomeric dichlor-anilines but three have hitherto been known. The authors have increased the number to five by obtaining the two amido compounds which are derived from o-chloro-benzene. o-dichlor-aniline, $C_6H_3(NH_2)ClCl$, 1.3.4, results from the action of Cl on the solution of m-chloro-acetanilide in acetic acid and distillation with HNaO, or from the reduction of nitro-o-dichloro-benzene, $C_6H_3(NO_2)ClCl$, 1.3.4. It crystallises in long needles, and melts at 71°. An unsymmetrical trichloro-benzene results from the replacement of the NH_2 group by Cl. o-dichlor-aniline, 1.2.3., is found among the products obtained by the reduction of the higher boiling portions of the reaction-products of Cl on nitro-benzene in the presence of $SbCl_5$. It melts at 23°, and solidifies in large prisms. The consecutive trichloro-benzene is obtained by the replacement of the NH_2 group by Cl.

Determination of the Fat in Butter.—M. Kretzschmar.—The author has tested the method of Hehner, who saponifies the fat of butter with alcoholic potash, and always obtains for pure butter from 85 to 88 per cent of insoluble fatty acids. The last figure is regarded by Hehner as the highest allowable for pure butter. A repetition of his experiments shows that the quantity of fatty acids amounts in cases to 90 per cent; a higher figure shows the presence of adulterations. Among other determinations made of insoluble fatty acids are the following:—

Lard	95·0 per cent
Castor oil	96·0 „
Human fat	95·3 „

L. Liebermann has repeated the recent experiments of Kosman (*Bull. de la Soc. Chim.*, xxviii.) on the "Transformation of Glycerin into Glycose," resulting from the action of iron-foil, potassium permanganate, or bichromate of potassium, and sulphuric acid on glycerin. He finds that the reduction of Fehling's solution, regarded as the proof of the presence of glycose in the reaction-products, is due to the formation of ferrous oxide, lower oxides of manganese, or chromic oxide, and that no change into sugar takes place.

J. Barsylowsky has obtained "M-Azo-toluen," $C_{14}H_{14}N_2$, by treating m-nitro-toluen with alcoholic potash and zinc. It forms large orange-red crystals, melting at 54°, and completes the series of the three isomeric azo-toluens.

A. Naumann details more particularly his "New Method of Determining Molecular Weights." As already communicated, he has ascertained that when the vapours of one liquid are driven through another liquid—with which it does not mix—the ratio between the quantities of the two liquids in the distillate, expressed in terms of their molecular weights, is equal to the ratio between the tensions of the vapours of the two liquids at the temperature at which the mixture distils. The practicability of this process for the determination of molecular weights may be seen from the following table of experiments carried out with steam. The first column contains the specific weights of the various substances, the second their boiling points, the third the temperature by the distillation with steam, the fourth the ratios between the quantities in the distillate expressed in terms of the molecular weights, and the fifth the ratios between the tensions of the vapours of the two liquids according to the temperature in column three:—

	I.	II.	III.	IV.	V.
C_6H_6.. ..	0·877	79·5°	69·1°	0·410	0·420
$C_6H_6CH_3$..	0·865	108·5	84·0	1·270	1·260
CCl_4.. ..	1·599	76·1	66·7	0·360	0·360
$C_6H_5NO_2$..	1·206	208·0	99·0	38·500	33·30
C_2H_5Br ..	1·407	72·0	37·0	0·064	0·065
$C_7H_5O_2C_2H_5$	1·048	213·0	99·1	49·910	45·99
$C_{10}H_8$ ..	—	218·0	98·8	38·980	36·40

As will be noticed, the slight differences in the last two columns are not sufficient to prevent a perfectly reliable determination as to whether the molecular weight of a body should be doubled or halved, and the new method can be used to advantage in settling many disputes as to the formulæ of organic compounds.

Dibromide of Acetic Acid.—C. Hell and O. Mühlhäuser.—Although bromine and acetic acid do not react on one another in the slightest when brought together, the addition of a minute quantity of CS_2 causes at once a development of heat, and the mixture is changed rapidly into a mass of crystals of the composition $C_2H_4O_2.Br_2$. They form at first orange-coloured tufts of needles, but change on standing into red thick prisms. The compound melts at 36°, is excessively hygroscopic, attacks the eyes, and can be sublimed. Water decomposes it. Other liquids, such as CCl_4 or $CHCl_3$, do not possess this peculiar catalytic action of CS_2, which only can cause the formation of this new molecular compound.

Determination of the Acetic Acid in Vinegar.—C. Jehn.—The author's method, which is designed for rapid technical work, consists in introducing 10 c.c. of the vinegar into a flask, containing an excess of sodium bicarbonate, from which the resultant CO_2 is conducted into a second flask filled with water. The volume of water expelled from this flask is collected in a cylinder which can be calibrated so as to show percentages at once.

Formic Acid.—V. Merz and F. Tibiricá.—The authors prepare this acid by conducting a stream of CO over soda-lime at 200° to 250°. The gas is rapidly absorbed, forming CHOONa, and the process can be used for the technical preparation of the acid as well as for a lecture experiment to show the direct formation of organic substances from inorganic.

Sulphates of Vanadium Tetroxide.—B. W. Gerland.

Incomplete Combustions.—L. Meyer.—The author gives the results of incomplete combustions of gases carried out with varying quantities of H, O, and CO, whirh tend to show the correctness of Horstmann's late deductions as to the absence of sudden changes in the proportion of $H_2O : CO_2$, while the proportions H : CO are gradually being altered.

Action of Hydrocyanic Acid.—O. Wallach.—The author shows that the transformation of chloral into dichlor-acetic acid by the action of CNK is not due to the weak alkaline properties of the latter, but to the presence of free hydrocyanic acid, and that a small quantity of HCN is sufficient to change unlimited amounts of chloral into the acid. The reaction results from the tendency of HCN, as nitrile of formic acid, to decompose water into its components (forming NH_2 and CO and—

$$CO + H_2O = CH_2O_2),$$

combined with the inclination of chloral as an aldehyd to take up an additional atom of O, and its readiness to exchange Cl for H and form HCl. Before these united attractions, the water present in the reaction is decomposed, but the hydrogen and oxygen thus set free are entirely appropriated by the chloral which has the strongest affinity for the two elements. A similar catalytic action of CNH has been noticed in the case of alloxan, and glyoxalic acid, and it is probable that the physiological action of the acid is due to an analogous influence on the oxidising and reducing agencies in the animal organism.

Tribromo-lactic Acid, Bromalide, and β-monobrom-acrylic Acid.—O. Wallach and F. Reincke.—Tribromo-lactic acid, $CBr_3.CH(OH)CO_2H$, is obtained in a crystallised form. It melts at 142°, is easily soluble in water, ether, and chloroform, and attacks the skin violently. The ethyl-ether crystallises in needles. The following bromalides have been obtained :—

$$CBr_3CH\begin{matrix}O\\COO\end{matrix}\Big\}CHCBr_3, \text{ melting at } 158°.$$

$$CBr_3CH\begin{matrix}O\\COO\end{matrix}\Big\}CHCCl_3, \text{ melting at } 135°.$$

$$CCl_3CH\begin{matrix}O\\COO\end{matrix}\Big\}CHCBr_3, \text{ melting at } 150°.$$

$$CH_3CH\begin{matrix}O\\COO\end{matrix}\Big\}CHCBr_3, \text{ melting at } 97°.$$

The compound melting at 135° gave on reduction β-monobromo-acrylic acid, CHBr..CH.CO_2H. It melts at 116°, and yields a silver salt crystallising in needles.

Substituted Thiamides.—H. Leo.—The author prepares these by the action of H_2S on acid imide chlorides. Benzanilide chloride, $C_6H_5CClNC_6H_5$, gives in this manner thio-benzanilide, $C_{13}H_{11}NS$, crystallising in yellow quadratic plates, and melting at 97°. Heating with PbO or HKO changes it into benzanilid. Fusion alone is accompanied by a development of H_2S, and the resultant body, which crystallises in colourless needles, possesses the composition $C_{27}H_{20}N_2S_2$. Thio-benz-toluidide, and thiacet-anilide were prepared in a similar manner.

Nicotin.—R. Laiblin.—By the action of $KMnO_4$ on pure nicotin in dilute solutions the author obtains an acid, $C_6H_5NO_2$, crystallising in colourless needles, and melting at 227°. Several salts are described, and it is shown to be the body obtained by Huber from the oxidation of nicotin, to which he assigned the formula $C_{10}H_8N_2O_3$.

Fluoranthene.—R. Fittig and F. Gebhard.—The authors have obtained a hydrocarbon, which they name Fluoranthene, from the residues of coal-tar used for the preparation of phenanthren, which appears to be identical with the hydrocarbon, idryl, lately found by Goldschmidt in Styrian petroleum. It is separated from accompanying pyrene by repeated crystallisations of the picrates, melts at 109°, and yields on oxidation a quinone and an acid, $C_{14}H_8O_3$. This crystallises in red needles, melting at 192°, is almost insoluble in water, is changed quantitatively into fluorene on distillation with Zn, and into diphenylene-ketone, on treatment with CaO. It is therefore a diphenylene-ketone-carbonic acid,—

$$\begin{matrix}C_6H_4\\COOH.C_6H_3\end{matrix}\!\!>\!CO.$$

Formation of Ammonium Nitrite.—R. Zoeller and E. Grete.—The authors have carried out a large variety of experiments on the results of the combustion of pure H in pure air, all of which show that the combustion is invariably accompanied by the formation of NO_2NH_4, the quantities being small, but sufficient to give decisive reactions with Nessler's solution.

Nitranilic Acid.—R. Nietzki.—By the action of nitrous acid on hydroquinone at 0°, the author obtains a dinitro-dioxy-quinone, $C_6(NO_2)_2(HO)_2O_2$, to which he applies the name nitranilic acid on account of the analogy with chloranilic acid. It crystallises in long prisms, is exceedingly soluble in water, possesses a strong astringent taste, and forms very insoluble crystalline salts with most metals.

Justus Liebig's Annalen der Chemie, Band 191, Heft 1 and 2.

Green and Blue Ultramarine.—(Second paper.)—Dr. J. Philipp.—In this important communication the author shows that green ultramarine is distinguished from the ordinary blue kind merely by the presence of sodium sulphide.

Sulph-acids of Parabrom- and Parachlor-benzoic Acids.—This essay consists of two distinct parts; one by Dr. C. Böttinger on sulpho-para-brom-benzoic acid with certain of its salts and derivatives, whilst the second, by Th. Collen, treats of sulpho-para-chlor-benzoic acid, with its potassium, sodium, silver, barium, magnesium, zinc, copper, and lead salts.

Communications from the Laboratory of the University of Freiburg, in Breisgau.—These communications consist of a paper by Adolph Claus on the introduction of cyanogen groups into organic compounds, and on the decomposition of organic cyanides. Among the subjects treated of are the behaviour of potassium cyanide with iodallyl, the action of the same cyanide upon monochlor-propylen, methyl-chloracetol, trichloro-butyric ether, trichloracetic ether, monochloro-crotonic ether, tricarballylic acid, crotaconic acid, cyancrotonic acid, and chloromaleïc ether.

Communications from the Laboratory of the University of Halle.—These comprise papers by E. Schmidt and J. Berendes on the "Volatile Acids of Croton Oil," and by W. Heintz, on the "Cause of the Formation of Vinyl-diacetonamin."

Action of Bromacetyl-bromide upon Zinc-methyl and Zinc-ethyl.—W. Winogradow.—The product of the reaction with zinc-methyl is not, as might be expected, a tertiary, but a secondary amylic alcohol, methyl-isopropyl-carbinol. With zinc-ethyl the product is a secondary octylic alcohol.

Studies on the Compounds of the Camphor Group.—J. Kachler.—In this, his fifth paper on the subject, the author treats of the oxidation-products of camphor, of the salts of hydro-oxy-camphoronic acid, of dinitro-hephthylic acid, and its behaviour respectively with sodium amalgam, with tin and hydrochloric acid, with caustic alkali, with hydrate of baryta, and with bromine; also of mono-nitro-

hephthylic acid, and its reactions with tin and hydrochloric acid, and with hydrate of baryta.

On Curarin.—Theodor Sachs.—The author criticises the results obtained by Dr. Preyer in 1865 (*Journal fur Prakt. Chemie*, 98, p. 228), and shows that the crystalline "curarin sulphuricum" of the latter is impure, containing phosphate and carbonate of lime, and is, moreover, almost inert in a physiological point of view. He finds that Preyer's process for the isolation of curarin is impracticable, since curare gives up mere traces of soluble matter when treated with absolute alcohol. Curarin gives with sulphuric acid not a blue colour, as asserted by Preyer, but a red. In crude curare it occurs not as an acetate but a sulphate. With the sodium chloride of platinum curarin gives a bulky faint yellowish white precipitate, which is quickly decomposed, taking a violet colour, the intensity of which keeps increasing.

MISCELLANEOUS.

The Royal Polytechnic.—On Saturday evening last Professor Pepper returned to the Royal Polytechnic. His appearance on the platform of the Lecture Theatre was the sign for an outburst of applause, showing how heartily he is welcomed back to the scene of his former labours. He delivered an instructive Lecture on "The Chemistry of the Sun." The Easter programme of the Institution includes a Lecture, by Professor Gardner, on "Clay and the Potter," which is illustrated by examples of pottery and a potter's wheel, showing the various stages in the production of familiar articles of pottery ware.

NOTES AND QUERIES.

Consumption of Guano, &c.—Can any of your readers give an idea of the average consumption and trade price in England of guano and phospho-guano; also the average consumption of potassic nitrate, sodic nitrate, and ammonic sulphate?—CHEMICUS.

MEETINGS FOR THE WEEK.

MONDAY, April 29th.—Medical, 8.
— Zoological, 1. (Anniversary).
TUESDAY 30th.—Civil Engineers, 8.
— Royal Institution, 3. "On Some Points in Vegetable Morphology," W. T. Thiselton Dyer, M.A.
— Anthropological, 8.
— Society of Arts, 8. "The Progress of Agriculture and Stock-farming in the Colony of Natal," P. C. Sutherland, M.D.
WEDNESDAY, May 1st.—Society of Arts, 8. "The Reforms in House Construction demanded by Sanitary Science," John Balbirnie, M.A.
— Microscopical, 8.
— Public Analysts, 8. "Composition of Honey," J. Campbell Brown, D.Sc. "Recent cases of Diseased Milk," G. W. Wigner. "Recent cases of Diseased Milk," C. Heisch. "Remarks on the work done by Public Analysts during 1877, under the Sale of Food and Drugs Act," G. W. Wigner.
— Royal Institution, 2. (Annual Meeting.)
THURSDAY, 2nd.—Royal 8.30.
— Royal Society Club, 6.30.
— Royal Institution, 3. "On Colour," Lord Rayleigh, M.A.
— Chemical, 8. "Chemical Aspect of Vegetable Physiology," Sidney H. Vines.
FRIDAY 3rd.—Royal Institution, 9. "Polarised Light: a Nocturne in Black and Yellow," William Spottiswoode, LL.D.
— Society of Arts, 8. "The Telegraph Routes between England and India," Major Bateman-Champain, R.E.
— Geologists' Association, 8.
SATURDAY, 4th.—Royal Institution, 3. "On Richard Steele," Prof. Henry Morley.

THE TELEPHONE.

Arrangements for Exhibiting or Fixing on application to EDWARD PATERSON, Telegraph Engineer, 3, Bedford Court, Covent Garden, W.C. Insulated Wires, Call-Bells, Insulators, and Galvanised Wire for Overhead Lines. Electric House-Bells, and all descriptions of Electrical Apparatus for experimental and other purposes. Price list post free 2 stamps.

Now ready, price 6d.,

EDISON'S

TALKING PHONOGRAPH

ITS CONSTRUCTION. ITS PRESENT CAPABILITIES. ITS FUTURE POSSIBILITIES.

London: E. J. DAVEY, Boy Court, Ludgate Hill, E.C.
And at all Booksellers and Railway Stations.

THE APPLICATIONS & PROCESSES OF CHEMISTRY IN THE USEFUL ARTS.

In One Volume, medium 8vo. pp. 1000, with 698 Woodcuts, price 42s. cloth,

INDUSTRIAL CHEMISTRY, a Manual for Use in Technical Colleges or Schools, also for Manufacturers and others, based upon a Translation (partly by Dr. T. D. BARRY) of STOHMANN and HENGLER'S German Edition of PAYEN'S *Precis de Chimie Industrielle*. Edited throughout and supplemented with Chapters on the Chemistry of the Metals, &c. By B. H. PAUL, Ph.D

London: LONGMANS & CO.

Now ready, Seventh Edition, with 98 Engravings, fcap. 8vo, 6s. 6d.

Practical Chemistry, including Analysis.
By JOHN E. BOWMAN.
Edited by CHARLES L. BLOXAM.
Professor of Chemistry in King's College, London.

*** In this edition the systematic course of Qualitative Analysis is arranged in a tabular form, and symbols and equations are largely used throughout the work.

J. & A. CHURCHILL, New Burlington-street.

Lately published, in one vol. of 1091 pages, with Diagrams and other Illustrations. 8vo. £1 11s. 6d.

EXPERIMENTAL RESEARCHES IN PURE, APPLIED, AND PHYSICAL CHEMISTRY.

By E. FRANKLAND, Ph.D. (Marburg), D.C.L., F.R.S., Professor of Chemistry in the Royal School of Mines, &c.

The work includes investigations on the Manufacture and Illuminating Power of Gas, on the Water Supply of Towns, and the Purification of Drainage from Towns and Manufactories.

Also by Professor FRANKLAND,

LECTURE NOTES FOR CHEMICAL STUDENTS. Second Edition. Vol. I. (Inorganic), 4s. Vol. II. (Organic), 5s.

London: J. VAN VOORST, 1, Paternoster Row.

Just published, 2nd Edition, 594 pp., 8vo., price 12s. 6d.

ORGANIC MATERIA MEDICA.
BY DR. MUTER.

Analytical Chemists will find this a concise and yet complete book of reference for the isolation and examination of the active principles of drugs. Special appendix on the microscopic characters of the starches in food and drugs. Copious index and qualitative courses for resins, &c.

Published by W. BAXTER at the Office of the South London School of Pharmacy, Kennington Cross, S.E., and sold by Messrs. Simpkin and Marshall and Messrs. Baillière, Tindal, and Cox.

Sulpho-cyanide of Calcium, containing about 26 to 28 per cent, for Sale.—Address, Alpha, CHEMICAL NEWS Office, Boy Court, Ludgate Hill, London, E.C.

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy. "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

THE SLATE RANGE BORAX COMPANY (LIMITED).—Tenders for the Purchase of the above Works and Land to be sent in on or before May 1, 1878, to the Liquidator George Beech, 9, Temple Row, Birmingham.

TO SUGAR REFINERS.

The Advertisers desire to Negotiate with a Gentleman thoroughly and practically conversant with the best Systems of Sugar Refining, with a view to his reconstructing and managing a well-known Refinery in England. It would be preferred, other things being equal, that he should himself embark some capital in the undertaking.—Apply by letter to E. G. C., care of Messrs. Tribe, Clarke, and Co., Public Accountants, 2, Moorgate Street Buildings, London, E.C.

April 13, 1878.

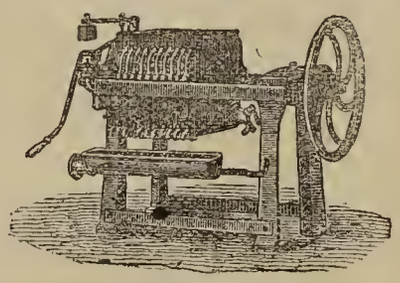
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

THE speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

BISULPHIDE OF CARBON.

We are now prepared to supply this article on favourable terms.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED,
161, 2, 3, Palmerston Buildings, Old Broad St.,
LONDON, E.C.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40s. and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

SPECIALITIES.

MANGANESE — Lump, Crystallised, Ground, and Prepared. Large stock of every description. *** *Suitable for all Trades.*

ARSENIC — Refined powdered, Lump, Grey, and Ruby.

FLUOR-SPAR — Finest produced. Medium and Common for all purposes.

BARYTES — Carbonate and Sulphate. All qualities of Lump and Ground.

BAUXITE — Of high percentage of Alumina and low in Iron.

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,
MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing are Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for udents, Schools, Colleges, &c.

NEW PATTERNS OF GEOLOGICAL HAMMERS.
EW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
8, CHARLOTTE STREET, FITZROY SQUARE

THE CHEMICAL NEWS.

Vol. XXXVII. No. 962.

THE CONSTITUTION OF MALT LIQUORS, AND THEIR INFLUENCE UPON DIGESTION AND NUTRITION.*

By J. J. COLEMAN, F.I.C., F.C.S.

A LIQUID resembling in appearance British porter, and labelled malt extract, has been sent to us from Germany pretty freely during the last few years. Our esteemed President (Dr. Andrew Fergus) brought it under my notice about 12 months ago, and acquainted me with the fact of its having—in many cases coming under his own observation—proved of service in restoring the energies of individuals suffering from faulty nutrition. Suffering at that time from an attack of illness which had not only reduced strength, but brought on extreme exhaustion from inability to appropriate food, I tried the effect of Hoff's malt extract, in the usual dose of a wineglassful twice or three times a day. Its use was followed by marked effects:—(1.) Food which had hitherto been found to pass the alimentary canal unchanged digested properly. (2.) There appeared an increased power of evolving animal heat and storing up fat.

Passing beyond my personal experience, I have experimented with it in other directions, particularly upon thin, cold, and aged people, who are unanimous in attributing to the liquid sustaining powers which are not commonly observed with alcoholic liquors.

It was therefore with considerable interest that I undertook its chemical examination. The mean result of a number of analyses showed it to consist of—

Alcohol	4·00 per cent.
Extractive matter	8·12 ,,
Water	87·88 ,,
	100·00

On evaporating to dryness and incinerating there was obtained of ash residue 0·05 per cent calculated upon the liquid.

The preparation is therefore a variety of porter or beer, as will easily be seen from reference to the analyses of a number of well-known beers. In appearance, however, it resembles porter rather than beer.

	Alcohol.	Extract.	Water.	Authority.
Hoff's malt extract ..	4·00	8·12	87·88	Coleman.
Royal Bavarian Bock beer..	4·00	7·20	88·80	Kaiser.
Royal Salvator ditto	4·20	8·00	87·80	Ditto.
London beer	4·50	5·00	90·50	Average.
London porter	4·00	4·50	91·50	Ditto.
Edinburgh ale	4·41	3·58	92·01	Paul.

In fact it reminds one of the Royal beers of Bavaria, the analysis of which it closely resembles. These beers were very lovingly dwelt upon by Liebig, who uses the following words:—"The beers of England and France, and for the most part those of Germany, become gradually sour by contact with the air. This defect does not belong to the beers of Bavaria, which may be preserved at pleasure in half-full casks without alteration in the air. This precious quality must be ascribed to a peculiar process employed for fermenting the wort,—that is, fermentation from below, which has solved one of the finest chemical problems." Without committing myself to any hypothetical views upon the nature of the process which has evolved the product, or as to its identity or non-identity with these celebrated Bavarian beers, it may be remarked that the liquid imported varies a little in its tendency to turn sour; sometimes it will not do so if exposed for weeks; other samples have turned sour with but slight exposure.

Referring again to the analysis of the liquid, there are two points to which I wish to direct attention:—The word "malt extract" is, by common consent of chemists, applied to that portion of a malt liquor which either has not been fermented into alcohol, or which after fermentation has *escaped* conversion into alcohol. Further, malt extract is a solid, and is obtained by evaporating the liquids containing it to dryness. It will be seen, therefore, that Hoff's liquid is something more than "malt extract," for it contains, besides this body, alcohol, and the usual quantity of carbonic acid gas, which causes any ordinary fermented liquor to froth up when liberated from the bottles containing it. In fact, the presence of large quantities of carbonic acid gas in Hoff's liquid shows that its alcohol has been produced by internal fermentation. But, on the other hand, this liquid of Hoff's produces, on evaporation to dryness, an extract which differs from the solid extract usually obtained from British beers. Malt extract obtained from such sources contains a large percentage of crystallisable sugar, whilst that from Hoff's liquid is almost entirely constituted of the dark brown uncrystallisable extractive matter present, but in less proportion in the beers of this country.

It will therefore be convenient to call this preparation merely Hoff's liquid, rather than lead to confusion by retaining the name it is commonly known by.

With the information gained by its analysis the question arises—To what constituents of Hoff's liquid are to be attributed its marked physiological effects? There are no doubt some people who will be inclined to say that the value of the liquid is its contained alcohol; there are no doubt others who would strenuously deny this. The question of the nutritive value of alcohol has been ably dealt with by—amongst others—two very distinguished men, viz., Dr. B. W. Richardson, F.R.S., and Dr. Edward Smith, F.R.S.,—not from a theoretical standpoint, but from that of laborious experiment.

Dr. Edward Smith administered, either to himself or one of his assistants, weighed quantities of food selected from the fatty, the starchy, or the albuminous articles of diet. He carefully noted the effect of these varied foods upon the function of respiration; that is—taking hold of the well-established principle that animal heat is produced by the oxidation of food by means of air drawn into the lungs—he collected and analysed the products of respiration, with the view to ascertain to what extent and how soon the carbon of the food is eliminated from the lungs in the form of carbonic acid.

It would be out of the question quoting all Dr. Edward Smith's results, which have been embodied in a number of papers read to the Royal Society; but this is what he says about brandy:—"1½ ounces of excellent brandy, diluted with 6 ounces of water, caused an average *decrease* of 0·2 grain in the carbonic acid expired per minute." In another experiment the average *decrease* was 0·38 grain. The quantity of air inspired fell 42, 37, and 34 cubic inches per minute in different experiments.

In regard to whisky he remarks—"1½ ounces of whisky containing 45 per cent of alcohol, in 6 ounces of cold water, caused an average decrease in the air expired of 0·33 grain per minute."

Let us compare these results with what was obtained from the same weight of sugar. He says—"1½ ounces of sugar dissolved in water gave a maximum *increase* in the carbonic acid evolved of 2·18 grains per minute, and an increase in the air inspired of 111 cubic inches per minute." We are thus shown that if by food is to be understood substances that act as fuel to the system, by being burnt into carbonic acid and water, then *no* chemical evidence can be obtained that alcohol has a right to be called food.

* A Paper read before the Philosophical Society of Glasgow, April 17, 1878.

Turning now to the evidence of Dr. Richardson. He says—"It would be impossible for me to recount the details of the long researches extending with intervals over three years, and which were conducted in my laboratory, to determine the influence of alcohol upon animal temperature. The facts obtained may be epitomised as follows:—The first effect of taking alcohol is the stage of excitement, viz., a rise of temperature of about half a degree, especially on the cutaneous surface. This might be considered as due to the combustion of alcohol; it is not so—it is, in truth, a process of cooling. During this stage, which is comparatively brief, the internal temperature is declining, and the reddened skin is so far reduced in tone that cold applied thereto increases the suffusion. It is this most deceptive stage which leads old observers into the error that alcohol warms the body. In the second stage the temperature first comes down to its natural standard, and then declines below what is natural. In man this fall is represented by three-fourths of a degree. During the third stage the fall in temperature rapidly increases, and amounts in man to as much as 2½°, and in birds to fully 5½ per cent. There is always during this stage a profound *comâ*, and whilst this lasts the temperature continues reduced. The sleep of apoplexy and the sleep of drunkenness may be distinguished by a marked difference in animal temperature. In apoplexy the temperature of the body is above, in drunkenness below, the natural standard of 98°." What, exclaims Dr. Richardson, is the inference? "It is that alcohol is not burned after the manner of food which supports animal combustion, but that it is decomposed into secondary products by oxidation, at the expense of the oxygen which ought to be applied to the natural heating of the body."

This concensus of evidence, coupled with the general experience that the so-called warming-up effects of a dose of alcohol, when taken upon an empty stomach, is followed by a reaction in about forty minutes, go far to prove that the *permanent* warming-up effects of Hoff's liquid cannot be owing to its contained alcohol. But supposing alcohol is not a direct food, may it not be a fat-forming food? This question has been dealt with by Dr. Richardson. He remarks, in his Cantor Lectures, "Notoriously ale and beer fatten, but this fattening may not be due to the alcohol itself, but to the sugar or starchy matters which are taken with it.

Dr. Richardson evidently sees a difficulty here, *but* offers an *insufficient* explanation. In the latter part of this paper I will show how the difficulty can be got rid of, but meanwhile note what he says:—"Alcohol, when it is largely taken, unless the will of the imbiber is very powerful, is wont to induce desire for undue sleep, or at least desire for physical repose. Under such circumstances there is an interference with ordinary nutritive processes. The wasted products of nutrition are imperfectly eliminated, the respiration becomes slower and less effective, and there is set up a series of changes tending independently of the alcohol as a direct producer of fat to development and deposit of fatty tissue in the body. Now this storing up of fat referred to by Dr. Richardson, which occurs with those who abuse alcoholic liquors, is a very different matter to the healthy nutrition which exists by one who has benefitted by drinking Hoff's liquid in small doses, or from the daily swallowing of a glass of London porter. *There is* a distinct nutritive effect produced in some cases of this kind which cannot be attributed to the influence of the alcohol contained in the liquid. I have heard married ladies declare that whilst suckling their strength would have succumbed had it not been for the sustaining effects of a bottle of porter taken daily. Evidence of this kind, which I believe is very common, is most important. The maternal instinct is far too strong to leave in doubt a problem which so materially affects the welfare of her offspring. I am not going to argue that fatness is to be considered in all cases a desirable condition; but the very appearance of a score of beer-drinking Englishmen, as compared with an equal number of whisky-drinking Scotchmen, is an indication of some specific effect which malt liquors have upon nutrition. Going a step further in this enquiry, let us ignore the evidence of Dr. Edward Smith and Dr. Richardson. We have no right to do so, but for the moment let it be admitted that alcohol is a food. Let us take typical cases, on the one hand, of a person imbibing a tumbler of porter every day; on the other hand, of a person swallowing Hoff's liquid daily, in accordance with the direction upon the label. The alcohol contained in the daily dose of Hoff's liquid will weigh about 100 grains; the extractive matter will weigh 200 grains. Without going into the minutia of chemical calculation, it may be stated that these substances contain about half their weight of carbon. Now, what proportion does this 150 grains bear to the total carbon consumed per day by an average man? Liebig, Playfair, and others have given us data. An average man consumes from 4000 to 6000 grains of carbon per day, so that the quantity contained in the daily dose of Hoff's liquid does not amount to more than 3 per cent of one's ordinary daily diet. In the case of a tumblerful of London porter containing, say, 4 per cent of alcohol and 5 per cent of extractive matter, the contained carbon would amount to about 200 grains, or about 4 per cent of an average day's diet. But a more familiar illustration may be offered—the whole of the food value of a glass of porter cannot exceed the weight of sugar equivalent to its alcohol or extractive matter, or about 1 ounce, whilst most people consume 3 ounces of sugar daily, employed in sweetening tea, coffee, and puddings or fruits.

These figures, if we are to believe Drs. Smith and Richardson, are too favourable; but, even in the form I have just given them, they are utterly insufficient to account for the marked physiological effects produced by the liquids I have referred to. These effects are frequently the sensation of being lifted from a feeling of semi-starvation to the condition of being effectually warmed and nourished, and are inexplicable from a chemica analysis of the liquids.

But, although these liquids have no food value of any importance, may they not have the power of influencing the digestion of *other food?* If the extractive matter of beer and porter be really malt extract, that is if it possesses the qualities of original malt, then the question is answered affirmatively. It is well known that if lukewarm water be poured upon fresh bruised malt a certain principle dissolves, which from the difficulty of separating it in the pure state has hitherto evaded chemical analysis. This substance, called diastase, is a ferment, being capable of converting an indefinite quantity of insoluble starch, through the stages of soluble starch and dextrin into the final product glucose or grape sugar. The brewer knows perfectly well that one part of malt contains sufficient diastase to render soluble and convert into grape sugar the starch of four or five times its weight of barley. Indeed, the first stage of brewing beer or porter—viz., the preparation of the wort—is simply converting by the aid of diastase a certain quantity of starch into sugar, which dissolves in the warm water of the mash, and is then converted into alcohol by the process of fermentation by the yeast cell. When the starch has become entirely converted into sugar—an operation which requires that the temperature shall not exceed 180°—then the wort is raised to the boiling-point, the hops at the same time being added. The object of this operation is stated in our text-books to be, first, the destruction of the diastase which has served its purpose; secondly, the precipitation of albuminous compounds likely to interfere with the keeping qualities of the beer. The diastase is believed to be destroyed at the boiling temperature, and the liquid ready for a new fermentation by the agency of yeast—at least as soon as it cools down to the proper temperature for the second fermentation. Hence it might be concluded, *a priori*, that it is impossible for malt liquors, as sold to the public, to contain diastase. It may be so; but the nature of these ferments are very obscure. It occurred to me that the extractive

matter of our ordinary malt liquors might contain the element of a ferment in some latent form, ready to be called into activity during the process of digestion.

The importance of such an agent may be estimated when it is considered that starch forms so large a proportion of the diet of man that in its natural state, or even when boiled, it is not soluble in the sense of being capable of absorption through a membrane (although it may become pasty or sticky), and that before it can be absorbed by the assimilative organs it *must* become soluble.

Starch constitutes 47·4 per cent of wheaten bread, 58·4 per cent of oatmeal, 18·8 per cent of potatoes, 66·3 per cent of wheaten flour, 79·1 per cent of rice, and 82 per cent of arrow root, so that the whole matter seems of sufficient importance to merit careful experiment. It is obvious that, if malt liquors exert a solvent action upon starch, the phenomena can be investigated external to the stomach, provided the necessary temperature and other conditions of the animal digestion be imitated. Such experiments have been conducted not only with Hoff's liquid, but with ordinary beers and porters.

The general method of procedure was to digest weighed quantities of bread or potatoes with measured quantities of the liquid I wished to examine, at blood heat, for the required number of hours it was determined the experiment should last; fresh water was then added, to bring the bulk of the original mixture exactly to its initial measurement; the semi-fluid liquid was then either filtered or dialysed, and a fractional part evaporated to dryness, or examined in other ways to determine the total solids dissolved. Simultaneously with each determination a blank experiment was made with pure bread or potatoes and water, so as to ensure comparisons being made under precisely identical conditions.

The latter precaution was especially necessary, as scarcely two samples of bread are alike as to their soluble constituents. By digesting ordinary bread two or three days with warm water it becomes soluble to the extent of 10 or 15 per cent, and in a short time becomes slightly putrid. Under such circumstances it is not unusual for the starch to become partially soluble by contact action with the decomposing gluten.

This fact was borne in mind most carefully from the very first, and in fact made the blank experiments absolutely necessary every time a fresh comparison had to be made.

Some of the experiments were conducted with ordinary beers and porters, as bought from neighbouring public-houses; but I am indebted to the courtesy of Messrs. Bass and Co., Messrs. Allsopp and Co., Messrs. Truman, Hanbury, and Co., and Messrs. Bates and Co., for samples sent me direct from their respective breweries.

Series I.

Fifty grms. of bread were digested at blood heat for six hours with 250 c.c. of water, and then dialysed into 500 c.c. of water. A fractional portion of the dialysed fluid was evaporated to dryness, to determine the total solids, and another portion was examined volumetrically for glucose by the cupric test. This formed the blank bread experiment.

	Total Solids. Grms.	Grape Sugar. Grms.
A. Blank bread experiment yielded ..	1·10	0·40
B. 60 grms. of Hoff's liquid yielded, by dialysing with the same quantity of water	1·10	0·36
Sum	2·20	0·76
A and B mixed together, and then treated as in the blank experiment	2·20	0·69
A and B mixed together, treated as in the blank experiment, but with the addition of a few drops of hydrochloric acid	2·20	0·68

These experiments were made simultaneous in five separate dialysers, and under exactly similar conditions, but the results did not give me any encouragement. They are, however, interesting in one point of view—they show what a small amount of crystalloids can be obtained from the dialysis of bread and water.

For a second series of experiments mashed potatoes were used, but in place of using Graham's dialyses, through the membranes of which dextrin will scarcely permeate, the semi-fluid masses were simply thrown upon a filter, no difficulty being experienced in getting perfectly clear filtrates.

Series II.

One hundred grms. of mashed potatoes were digested for six hours, at blood heat, with 500 c.c. of water, and then filtered; a fractional part of the filtrate, after dilution to the original bulk, being evaporated to dryness, for the purpose of estimating the dissolved solids.

	Grms. of Dissolved Solids.
A. Blank experiment, conducted as above, yielded	4·86
B. 60 grms. of Hoff's liquid yielded	5·00
Sum	9·86
A mixed with B, and treated as in the blank experiment	9·66
A mixed with B, and treated as in the blank experiment, but with a few drops of HCl extra	9·56

The results were again negative, and the matter was laid aside for some months. It then occurred to me that in all these experiments the conditions represented stomachic, but not intestinal, digestion. The digestion of the stomach is always effected by secretions which are acid, and it is essentially a peptic or albuminoid digestion.

With the exception of such action as may ensue from contact with the saliva, the starchy matters of the food in great part pass through the stomach unchanged, and do not become digested until they pass that organ and come in contact with the pancreatic and intestinal juices, which are always alkaline. Bread has generally an acid reaction sufficiently distinct to affect litmus. Malt liquors are invariably and still more decidedly acid, so that, independently of the acid purposely added in some of my experiments, there must have been in all cases a decided acid reaction. It was therefore determined to commence these experiments anew, and with a slight alkaline reaction, as similar as possible to that of the saliva or pancreatic juice.

Series III.

Fifty grms. of bread were digested, at blood heat, with 200 c.c. of water, made faintly alkaline with sodic hydrate. The total dissolved solids were then estimated after digestion for six hours at blood heat, and filtration in the usual way.

	Dissolved Solids in Grms.
A. Blank experiment, yielded..	6·00
B. 60 grms. of Hoff's liquid, exactly neutralised, yielded	5·51
Sum	11·51
A and B mixed together, and subjected to the conditions of the blank experiment, yielded	16·33

For the first time I had clear evidence of the correctness of my surmises: 4·82 grms. of the bread became soluble by the agency of the Hoff's liquid, or about 20 per cent of its constituent starch.

A portion of the semi-fluid masses were also dialysed, with the following results:—

	Grms.
A contained of grape-sugar	0·26
B „ „	0·39
Sum	0·65
A and B mixed together; and treated as in the blank experiment, yielded of grape-sugar	0·98

Series IV.

Thirty grms. of bread were digested, at blood heat, for five hours, with 300 c.c. of water, made faintly alkaline, filtered, and the dissolved solids determined.

	Dissolved Solids in Grms.
A. Blank experiment, conducted as above	3·24
B. 180 grms. of public-house beer, made neutral and evaporated, yielded	13·54
Sum	16·78
A mixed with B, and treated as in the blank experiment, yielded	19·00

It appears therefore that ordinary beer possesses a solvent power similar to that of Hoff's liquid, but to an inferior degree.

Series V.

Thirty grms. of bread were digested for twelve hours, at blood heat, with 300 c.c. of water, made faintly alkaline, filtered, and the dissolved solids determined.

	Dissolved Solids in Grms.
A. Blank experiment, conducted as above, yielded	6·22
B. 90 grms. of Hoff's liquid, made neutral and evaporated, yielded	7·50
Sum	13·72
A and B mixed together, and treated as in the blank experiment, yielded	20·73
A. Blank experiment, conducted as above, yielded	6·22
D. 180 grms. of beer from a public-house, made neutral and evaporated, yielded	13·54
Sum	19·76
A mixed with D, and treated as in the blank experiment, yielded	23·30

In these experiments it is demonstrated that, with twenty-four hours' digestion, 90 grms. of Hoff's liquid dissolved 50 per cent of the starch of 30 grms. of bread, and that it requires four times as much beer to effect the same result.

Series VI.

Public-house bottled porter, examined in the same way, indicated six parts to be equivalent in solvent power to one part of Hoff's liquid. This porter contained, however, only 4·7 per cent of extractive matter.

These experiments were satisfactory. The quantity of sodic or potassic hydrate added in each experiment was very minute, and regulated with the utmost care, to avoid communicating an alkalinity more than sufficient to imitate the natural alkalinity of the saliva. It was, however, thought advisable to eliminate doubts on this head by a series of experiments in which the alkaline reaction was established by bicarbonate of soda or tribasic phosphate of soda.

Series VII.

Thirty-two grms. of bread were digested for twenty-four hours, at blood heat, with 300 c.c. of water, made alkaline by 1 grm. of bicarbonate of soda and ½ a grm. of tribasic phosphate of soda; then filtered, and the dissolved solids determined.

	Dissolved Solids in Grms.
A. Blank experiment, conducted as above, yielded	8·16
B. 90 grms. of Burton ale, neutralised and evaporated, yielded	11·50
Sum	19·66
A and B mixed together, and treated as in the blank experiment, yielded	21·80
A. Blank experiment, as above, yielded	8·16
C. 90 grms. of London porter, neutralised and evaporated to dryness, yielded	7·66
Sum	15·82
A mixed with C, and heated as in the blank experiment, yielded	21·81
A. Blank experiment, as above, yielded	8·16
D. 90 grms. of Wrexham ale, neutralised, yielded	7·20
Sum	15·36
A mixed with D, and treated as in the blank experiment, yielded	19·20
A. Blank experiment, as above, yielded	8·16
E. 90 grms. of Hoff's liquid, neutralised and evaporated, yielded	7·30
Sum	15·46
A mixed with E, and treated as in the blank experiment, yielded	23·80

These experiments indicate as follows, the figures being calculated to avoid decimals, and to show the amount of starch in the bread, which became soluble by the agency of the various liquors, the bread used in each case being of the same weight.

The Burton ale dissolved	15	per cent	of the starch.
The London porter	„ 40	„	„
The Wrexham ale	„ 26	„	„
Hoff's liquid	„ 60	„	„

In an eighth series of experiments it was determined to eliminate all sources of error existing from the action of reagents upon gluten, by using pure starch, which would indeed have been used earlier had it not been that this investigation was purposely undertaken to solve a dietetic problem, the conditions of which are not the swallowing of pure starch.

Series VIII.

Fifteen grms. of starch mixed with 300 c.c. of boiling water, so as to form a uniform paste, was made faintly alkaline with 3 grms. of bicarbonate of soda, and digested at blood heat for twenty-four hours. The pasty mass was then diluted with water to 600 c.c., and thrown upon a close filter of thick white paper. A fractional portion of the filtrate, which was brilliantly clear, was evaporated to dryness.

	Dissolved Solids in Grms
A. Blank experiment, conducted as above, yielded	5·18
B. 60 grms. Burton ale, neutralised, yielded ..	8·00
Sum	13·18
A and B mixed, and treated as in the blank experiment, yielded	14·60
A. Blank experiment, conducted as above, yielded	5·18
C. 60 grms. of London porter, neutralised, yielded	4·28
Sum	9·46
A and C mixed, and treated as in the blank experiment, yielded	15·01

This last series of experiments is conclusive, and forms a fitting termination to this stage of the investigation, which has established a food value for malt liquors not generally understood. Chemically of course it is interesting to know into what substance or substances the starch is transformed—whether into ordinary dextrin, Bechamp's soluble starch, Dubunfrants's maltose, or ordinary glucose.

These are questions I do not propose at present going into; but it may be remarked that the dissolved solids partook more of a gummy than a saccharine character. Neither have I been able to fix the limits of the reactions with any degree of certainty; but it is clear—and this physiologically is of the utmost importance—that there is a powerful solvent action exerted by all malt liquors that I have examined, which, with the peristaltic and other muscular action of the digestive organs, has probably been but poorly imitated by the laboratory experiments that have been undertaken.

Another very interesting point came out in this enquiry, viz., that it was not the richest ales coming from our large breweries which afforded the best result, which may be explained in two ways—either from the fact that in large breweries the diastase of malt is made to go as far as possible, by using raw grain with the original malt, or, secondly, as suggested by my friend Dr. Wallace, from the excess of alcohol in strong ales precipitating the diastase before it reaches the consumer.

Before concluding this paper I must remark that the possibility of malt, in virtue of its diastase, becoming a useful article of food was discussed many years ago. It was supposed that cattle could be made to assimilate their food better and fatten quicker by mixing with their ordinary diet a certain percentage of malt. Mr. J. B. Lawes conducted very elaborate experiments for the Board of Trade, in 1866, on the relative values of unmalted and malted barley for stock. These experiments showed that, with healthy stock, the addition of malt to their food produced no more increase of weight than the addition of barley to which the malt was equivalent. But this is what might reasonably be expected. In a healthy state neither man nor animal requires more digestive solvent than what is supplied naturally. But unfortunately a large percentage of our fellow-men, especially the inhabitants of cities, are not in a perfect state of health; nay, more, vast numbers—from the wear and tear of life—are habitual dyspeptics, so that an innocent aid to Nature is sometimes a daily necessity. On the other hand, there are many people whose tendency to develop fat, or secrete sugar in the form of diabetic urine, indicates at once that Nature requires no assistance by the aid of such a ferment as diastase.

ON A NEW METHOD FOR THE SEPARATION AND SUBSEQUENT TREATMENT OF PRECIPITATES IN CHEMICAL ANALYSIS.*

By F. A. GOOCH.

The introduction of Bunsen's method of filtration and immediate ignition of precipitates in the moist condition has left little to be desired as regards accuracy of result and rapidity of execution, in the treatment of precipitates which may be submitted to high temperatures in contact with carbonaceous matter. In analytical methods which require that filter-paper and precipitate shall be ignited apart, or dried together at a temperature below the point at which paper begins to char, the same degree of exactness has not, in general, been hitherto attained.

To obviate the difficulty of bringing a paper filter of ordinary dimensions, particularly when covered with a voluminous precipitate, to a definite condition of desiccation, the sand filters of Dr. Gibbs and Taylor,* the porous cones of Munroe,† and finally the process of reverse filtering, first applied to qualitative work by Carmichael,‡ improved by Casamajor,§ and thoroughly elaborated by Professor Cooke,‖ have been successively brought forward.

The latter process gives most excellent results in the separation of precipitates which settle quickly and completely; and, inasmuch as many precipitates which of themselves are not inclined to fall rapidly may be made to do so by proper treatment (by boiling, for example, the addition of ammonium salts, Chatard's¶ method of granulating gelatinous precipitates, or other similar device), the field of usefulness of this process is wide.

The sand-filters in skilful hands, and the porous cones with no more than ordinary care, give accurate results, and possess, moreover, the advantage of being applicable to the filtration of liquids which quickly destroy woody fibre. The length of time required to dry them thoroughly, and their sensitiveness to atmospheric conditions, are their great drawbacks.

For the simple filtration of corrosive liquids without reference to a subsequent estimation of the precipitate, filters of sand, broken glass, garnets, and fibrous asbestos have for a long time been used. More recently, asbestos has been moulded into the shape of an ordinary filter: in the dry state by Löwe,** by rubbing between a hollow and solid wooden cones; in the wet state by Gruner,†† by grinding asbestos, mixed in a mortar with water, to a pulp, transferring the mixture to a funnel choked with asbestos, inserting an accurately fitting cone of brass gauze, which presses the asbestos against the walls of the funnel, pouring off the water, carefully removing the cone and drying the layer of asbestos which adheres to the glass. Böttger‡‡ has used filters of gun-cotton; and Bunsen§§ has devised a filtering apparatus for corrosive liquids to be attached to his pump, which consists of a disc of artificial pumice fitted to a conical tube and packed around its edge with fibrous asbestos.

None of these later-mentioned methods, however, are well adapted to the quantitative estimation of precipitates.

Impressed with the desirability of further improvement in those processes of quantitative analysis which involve the use of dried filters, or the separation of filter and precipitate before ignition, I have had the good fortune, in taking the matter up in turn, to succeed in devising and preparing a felt of anhydrous asbestos, which is capable of filtering liquids with a rapidity and efficiency at least as great as may be obtained by the use of good filter paper; is light, compact, incombustible at the highest temperatures used in analytical processes; is not acted upon by acids (excepting hydrofluoric acid) or alkalies; if sufficiently coherent to resist entirely the disintegrating action of a liquid forced through it under the pressure of the Bunsen pump, and which may moreover be prepared by a very simple process: in short, a filtering material which, in my belief, makes it possible to reach a high degree of accuracy in many analytical processes which hitherto have been none of the best, and to add to those already known new methods which previously have been impracticable.

My mode of preparing and using the asbestos felt is as follows:—

First. White, silky, anhydrous asbestos is scraped to a fine short down with an ordinary knife-blade, boiled with hydrochloric acid to remove traces of iron or other soluble matter, washed by decantation, and set aside for use.

* Read before the American Academy o Sciences, Feb. 13, 1878.

* *Am. Jour.* [2], vol. xliv., p. 215.
† *Am. Jour.* [3], vol. i., p. 1.
‡ *Zeitschr. f. Chem.* [N.F.], Bd. 6, p. 481.
§ *Am. Chem.*, vol. v., p 441.
‖ *Proc. Am. Acad.*, vol. xii., p. 124.
¶ *Am. Jour.* [2], vol. i., p. 247.
** *Dingl. pol. Jour.* cxlviii, 444.
†† *Jahresb. Chem.* 1869, p. 990.
‡‡ *Dingl. pol. Jour.* clv., p. 463.
§§ *Ann. Ch. Pharm.* cxlviii., p. 290.

Secondly. A platinum crucible of ordinary size, preferably of the broad low pattern (Fig. 1), is chosen, and the bottom (Fig. 2) perforated with fine holes (the more numerous and the finer, the better) by means of a steel point; or, better still, the bottom may be made of fine platinum gauze. Next, a Bunsen funnel of the proper size is selected, and—following Munroe's plan for holding his porous cones—over the top a short

Fig 1.

Fig 2.

piece of rubber tubing is stretched and drawn down until the portion above the funnel arranges itself at right angles to the direction of the stem. Within the opening in the rubber, the perforated crucible is fitted as shown in figure 3, and the funnel is connected with the receiver of a Bunsen pump or other exhausting apparatus in the ordinary manner.

To make the asbestos felt, the pressure of the pump is applied, and a little of the asbestos prepared as described, and suspended in water, is poured into the crucible. The rubber and the crucible are held together by the pressure of the vacuum-pump with sufficient force to make an air-tight joint; the water is drawn through, and the asbestos is deposited almost instantly in a close compact layer upon the perforated bottom; more asbestos (if necessary) in suspension as before being poured upon the first, until the layer becomes sufficiently thick for the purpose for which it is intended. Finally, a little distilled water

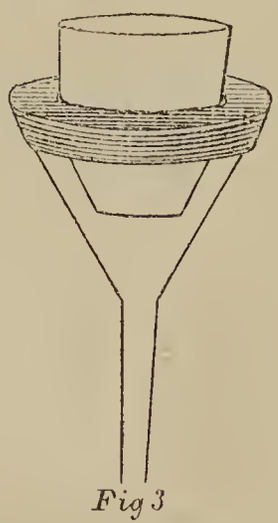


Fig 3

is drawn through the apparatus to wash away any filaments that might cling to the under side, and the filter is ready for use: the whole process occupying less time than is necessary to fold and fit an ordinary paper-filter to a funnel.

To prepare the filter for the estimation of a precipitate, the crucible with the felt undisturbed is removed from the funnel and ignited. In case the precipitate, to be subsequently collected, must be heated to a very high temperature for a long time, it is better to enclose the perforated crucible with its felt within another crucible; because, in such cases, asbestos felt is apt to curl at the edges, and without such precaution some of the precipitate might drop through the perforations and be lost. For drying at low temperatures, however, and even for ordinary ignitions, a second crucible is unnecessary; but, during the ignition of an easily reducible substance, care must be taken to prevent the contact of unburnt gas with the perforated bottom.

To perform the filtration, the crucible is replaced in the funnel, the pressure applied, and the process conducted precisely as in an ordinary filtration by the Bunsen pump. It is nccessary to observe that the vacuum-pump is to be started before pouring the liquid upon the filter. The final drying or ignition, as the case may be, of precipitate and filter is made without difficulty, or need of extra precaution.

When turbid liquids are to be filtered, or gelatinous precipitates to be separated, instead of the perforated crucible, I prefer to use a platinum cone (Figs. 4 and 5), the upper part of foil (to make a tight joint with the rubber fitting of the funnel), the lower of gauze. The method of covering the gauze with felt is identical with that described above. By reason of the larger filtering surface of this apparatus, the tendency to become clogged is, of course, very much diminished. When subjected to

Fig 4

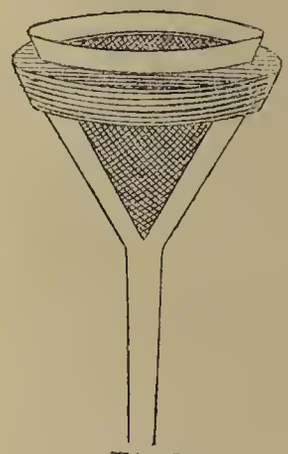


Fig 5

prolonged ignition, the gauze cone is enclosed within a crucible or a cone of platinum foil.

In operations in which platinum is liable to receive injury, a porcelain crucible, with a perforated bottom, may be used; but recourse to this is rarely necessary, particularly when one may use the gauze cone protected, as it is, by asbestos felt; moreover, the perforation of porcelain with numerous fine holes is a matter of considerable difficulty and expense.

Asbestos felt may be also used in the process of reverse filtering, it being merely necessary to dip the platinum rose into the asbestos mixture, after starting the vacuum-pump, in order to make the felt. The rose, with the felt attached, and the vessel in which the precipitate is collected, are to be weighed together, both before and after filtration.

Nothing can be simpler than the whole method of preparation and use of the apparatus which I have described, and its efficiency is extremely great. Clean water may, under the pressure of a Bunsen pump, be passed through a gauze cone coated with asbestos felt, which exposes a filtering surface of twenty-four square centimetres (nearly the same as that of a paper-filter, eight centimetres in diameter, when folded in the ordinary manner), with ease at the rate of a litre per minute.

When the filtering surface is less, the rapidity of filtration is, of course, somewhat diminished, but always exceeds that of paper of the same dimensions. When the felt is deposited upon gauze, the layer may be surprisingly thin and yet be efficient enough for all ordinary purposes. If the layer of felt be quite thick, the filtrate from baric sulphate freshly precipitated in the cold may be made to pass through clear. But the great superiority of asbestos felt lies in its constancy of weight, whether dried at high or low temperatures, the rapidity with which it may be safely and completely dried, and its refractoriness as regards acids (excepting hydrofluoric acid) and alkalies. These advantages appear most prominently in processes which involve the separation and desiccation:—

First, of precipitates which (like K_2PtCl_6, $[Hg_2]Cl_2$) must be dried at low temperatures, on account of a

tendency to decompose spontaneously at high temperatures;

Secondly, of precipitates which

(like Sb_2S_3, $PbSO_4$, $ZnCO_3$)

have usually been dried slowly and tediously at low temperatures, or have been separated from the filter before ignition, to avoid the danger of reduction by heating in contact with carbon;

Thirdly, of precipitates which

(like $(NH_4)_2MgP_2O_8$, $(NH_4)_2Mn_2P_2O_8$)

may be ignited in contact with carbon, but which make its complete combustion difficult.

In all cases, the time required to dry or ignite precipitate and filter is a minimum, inasmuch as heat may be applied as soon and to as high a degree as the precipitate itself will permit. Even in processes in which paper filters find their most convenient application, paper has generally no superiority over asbestos felt.

To illustrate the cohesiveness and refractory nature of the felt, I append the account of a single experiment. All of the liquids used had been previously filtered, excepting the distilled water with which the filter was washed, after the passage of each liquid. This precaution was considered unnecessary in the case of the water; but, if it had been taken, the slight *increase* of weight which was observed during the experiment would probably have been prevented.

Weight, in grammes, of crucible and felt, after ignition	20·2020
After second ignition	20·2020
After passing 100 cm^3 of strong HCl through the filter *ten* times, washing and igniting	20·2020
After passing 100 cm^3 of strong HNO_3 through the filter *ten* times, washing and igniting	20·2021
After passing 100 cm^3 of strong H_2SO_4 through the filter *five* times, washing and igniting	20·2022
After passing 100 cm^3 of a mixture of strong H_2SO_4 and water in equal parts, *ten* times through the filter, washing and igniting	20·2024
After passing 100 cm^3 of water, containing in solution 50 grammes of NaOH *ten* times through the filter, washing and igniting	20·2028
Weight of crucible	20·1932
„ felt	0·0088

The whole process, involving, in all, the filtration of five litres of liquid (of which one litre was viscous), more than forty changes of the receiver, together with the ignition, cooling, and weighing of the crucible and felt seven times, was completed in two hours and ten minutes. The disc of felt was eleven millimetres in diameter.

ON SOME ANALYSES OF GLASS.

By SERGIUS KERN, M.E., St. Petersburg.

The author expects that the following remarks on the analyses of an old water-gauge may be of some interest:—

About seven months ago the water-gauge was fitted to a boiler which was daily working. The glass of the gauge has now been found to be corroded to a great extent, and it is therefore replaced by a new one. The results of the analyses are the following:—

	Glass Tube. Upper Part. Per cent.	Glass Tube. Lower Part. Per cent.
Silica	72·65	72·62
Calcium oxide	9·94	9·96
Sodium oxide	15·10	15·42
Alumina + Ferric oxide	2·18	1·98
Sulphuric acid	0·01	traces
	99·88	99·98

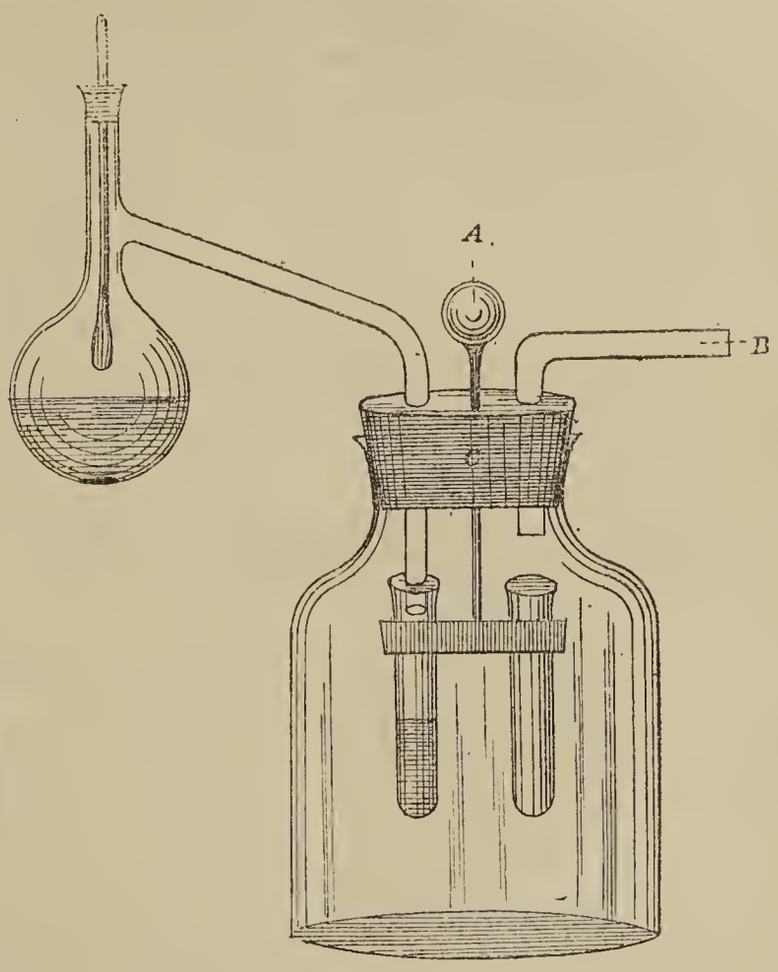
These analyses show the unfitness of a glass of such composition for most purposes. Such a glass cannot well stand the action of many reagents, or even that of water. Indeed, there is an excess of alkali and a rather small quantity of calcium oxide. The percentage of silica is nearly the normal amount. In order to prevent accidents, water-gauges carefully prepared and of the best quality ought only to be used.

Obouchoff Steel Works.

NEW FORM OF APPARATUS FOR FRACTIONAL DISTILLATION UNDER DIMINISHED PRESSURE.

By E. J. BEVAN.

The figure needs no explanation beyond stating that by means of the rod A moving, air tight, in the cork C, any



of the tubes which it carries below may be brought under the delivery tube of the fractionating flask. The apparatus is connected at B with an exhausting pump.

Owens College,
March 25.

Action of Ozone upon Iodine.—J. Ogier.—If the effluve is caused to act upon a mixture of oxygen and iodine in a large effluve-tube, heated in the acidulated liquid which serves as an electrode so as to keep the iodine in a state of vapour, the different oxygen compounds of iodine are rapidly formed in different parts of the tube. At the lower part, where the iodine is in excess, there is a deposit of iodous acid, more or less mixed with iodine. Above is a lemon-yellow layer of hypoiodic acid. At the upper part towards the extremity of the annular space where the effluve is produced iodic acid accumulates, whilst the annular space itself is lined with a thin white layer of periodic acid.—*Comptes Rendus*, lxxxvi., No. 11.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 11, March 18, 1878.

Researches on the Absorption of the Ultra-Violet Rays by Various Substances.—J. J. Soret.—Spectral analysis by absorption has been hitherto almost exclusively limited to the visible rays, and important results will doubtless be obtained by extending it to the ultra-violet rays. The use of the spectroscope with a fluorescent eye-piece greatly facilitates this class of observations, and renders it possible to operate upon the ultra-violet spectrum in its full extent with almost as much ease as upon the luminous spectrum. It is sufficient to be provided with an instrument fitted with quartz lenses and prisms and a good induction apparatus in order to study as regards absorption the numerous bodies, which are colourless in the ordinary sense of the word, but the bulk of which are chroic, that is to say, intercept a part of the invisible rays. The author has undertaken in this direction a series of researches, employing as a source of light the induction sparks obtained between various metals, such as cadmium, zinc, aluminium, and iron. The rays were concentrated upon the slit of the spectroscope by a lens of quartz with a short focus. Among the substances experimented upon are quartz, Iceland spar, distilled water, sea-water, nitric acid, &c. A large number of substances at certain degrees of dilution give rise to absorption-bands in the ultra-violet spectrum, such as the alkaline chromates and bichromates (250 m.grm. neutral chromate of potassa to the litre) which present two absorption-bands, nitrate of potassa, sulphates of didymium and cæsium, permanganate, the aqueous solution of sulphurous acid, which display one absorption-band. Commercial caustic ammonia, and the sulphates and hydrochorates prepared with this product, also show an absorption-band, due, however, to a foreign substance not easily eliminated.

On a New Telephone, the so-called "Mercurial."—A. Breguet.—This instrument cannot be intelligibly described without the accompanying illustration.

Detection of Plumbic Oxide in Pharmaceutical Bismuth Sub-nitrate.—A. Carnot.—The author takes from 10 to 20 grms. sub-nitrate and treats it with strong hydrochloric acid in a porcelain capsule. The solution s concentrated to a syrup, slightly acidified so as to render it perfectly fluid, a few drops of sulphuric acid are added, and 30 to 40 c.c. of alcohol. If the alcohol is too weak a white turbidity appears in the liquid, which may be got rid of by the addition of a little hydrochloric acid. It is let stand for a day, decanted over a small filter, washed by decantation with alcohol, acidified with two or three drops of hydrochloric acid, the precipitate received on the filter, and the washing is completed with pure alcohol. When dry the filter is separated, burnt by itself, the ashes added to the residue in a very small balanced porcelain capsule, moistened with sulphuric acid, evaporated, and heated to redness, and the residue weighed as lead sulphate.

Researches on Gallium.—A. Dupré.—M. Lecoq de Boisbaudran placed at the author's disposal 2 grms. of this metal. At 260° pure dry oxygen exerted no sensible action upon the metal, but at incipient redness it loses its brilliance, and is covered with a very thin pellicle of a greyish blue colour: at a full red heat the layer of oxide becomes more distinct, but it protects the metal from further oxidation. At bright redness a slight sublimate of oxide was formed in the hottest parts of the tube. The simplest way of obtaining the oxide is the decomposition of the nitrate. The gallium is treated with monohydrated acid free from nitrous vapours; in the cold the action is almost *nil*, but at 40° to 50° it begins and is continued regularly with the formation of a grey deposit very slow to dissolve. The nitric solution, after being deprived of a part of its acid over the open fire, was heated in a stove to 110°, when a commencement of decomposition was manifested. The salt, partly decomposed, was then taken up in water, evaporated to a syrup in the water-bath, and placed whilst cooling in an exsiccator. The nitrate then forms a white compact mass, very deliquescent, and giving off an odour of nitric acid, which, as well as the moisture, may be removed in a dry vacuum, or in a current of dry air at 40°. The dry nitrate, heated to 200° in a current of dry air, loses 63·8 per cent of its weight. This loss, representing nitric acid, renders it probable that the salt is a nitrate of the sesquioxide. When this salt is decomposed by heat the sesquioxide remains as a white, fritted, very friable mass, which, if heated in a current of pure dry hydrogen, sublimes in part and suffers reduction to some extent. At a cherry-red heat the action of hydrogen gave a bluish grey substance resembling the pellicle formed on the oxidation of gallium. Notwithstanding its blue tint the oxide does not seem to contain appreciable traces of metal, for on treatment with nitric acid there is no evolution of nitrous vapours. It dissolves also in dilute sulphuric acid without escape of gas, and the solution reduces permanganate. This greyish blue matter seems to be a lower oxide of gallium, probably the protoxide, for the sulphuric solution of the sesquioxide does not reduce permanganate. Sulphate of sesquioxide mixed with ammonium sulphate and set aside yields crystals of gallic alum; whilst the salt which appears to be sulphate of protoxide produces nothing similar.

No. 12, March 25, 1878.

Effects of the Rheostatic Machine.—G. Planté.—The effects produced by this apparatus much resemble those obtained with electric machines and induction coils, but present at the same time certain distinctions. The difference between the characters of the electricity emanating from the two poles is perhaps more marked. The light produced in a vacuum is brighter than that of electric machines, and when the rotatory movement is rapid it is as bright and continuous as that of induction-coils.

Hydrate of Ether.—C. Tanret.—This compound, $C_8H_{10}O_2+2H_2O_2$, is formed in the shape of a hoar-frost, and resembles the substances to which Mr. Guthrie has given the name of cryohydrates.

Constitution of Wool and of Certain Similar Products.—P. Schutzenberger.—Wool heated to 150° to 180° with water and three or four parts of hydrate of baryta behaves like the albuminoids yielding ammonia, acetic, carbonic, and oxalic acids, and various amidic compounds, among which caproic leucin, tryosin, butyric and valeric leucin, propionic leucin, and glucoprotein.

Justus Liebig's Annalen der Chemie, Band 191, Heft 1 and 2.

Communications from the Chemical Laboratory of the University of Greifswald.—These consist of papers by H. Limpricht on "Bromised Sulphobenzolic Acids; by Dr. A. Langfurth, on the "Bromine Derivatives of Metamido-sulpho-benzolic Acid;" and by Dr. R. Bässmann, on the "Sulpho-acids of Symmetric Tribrom-benzol and its Derivatives."

Les Mondes, Revue Hebdomadaire des Sciences, No. 11, March 14, 1878.

This issue contains no original chemical matter.

No. 12, March, 21, 1878.

Ultramarine, with the further addition of sulphate of

tin and alum, is said to be used for improving the colour of certain kinds of powdered sugar.

The lees of wine are now employed as a source of tartaric acid.

MISCELLANEOUS.

Serious Accident to Mr. William Baker, of Sheffield.—On Monday evening last Mr. W. Baker spent a few hours at the Sheffield Club, of which he is a member, and about 11 o'clock he prepared to go home. He had been in the billiard room, which is at the very top of the building. During the evening he had been performing a number of athletic feats, and when he left the billiard room, instead of descending the stairs in the ordinary manner, he attempted to slide down the banisters. He had only gone a very short distance when he lost his balance and fell over. He pitched upon the banisters of the next flight, and from them to the next banisters, and finally dashed head foremost upon the tiled floor of the hall. His skull was terribly fractured, and a portion of his brain protruded. He was taken into one of the club-rooms, where he remained during the night, and on Wednesday morning he was removed to his residence. Not the slightest hopes are entertained of his recovery.

Russian Scientific News.—Prof. Lesgaft has delivered an interesting lecture before the Technical Society on the *modus operandi* of baking biscuits and the preparation of conserves. The experiments of the lecturer proved that in order to support the human organism in good health the proportion between the nitrogen and carbon of the food must be as 1 : 4·5, so that 750 grms. of solid food are quite sufficient for daily nourishment. This quantity, according to his experiments, must contain—

Albuminous matters	150 grms.
Fat	100 ,,
Hydrocarbons	475 ,,
Various salts	25 ,,

Prof. Lesgaft believes that a man at work requires not less than 600 grms. of meat.

M. Pallizen presented to the Imperial Academy of Sciences a very rare specimen of a complete skull of the semi-fossil animal, *Elasmotherium*, the nearest relative of our rhinoceros. The skull was found in the alluvial sands of the River Volga, near Sarepta, and is more than 3 feet in length.

M. Petrouchevsky has made some experiments with the Jablochkoff electric candle. He measured the intensity of the light given by them. Two specimens of candles were used for this purpose :—(1) Candles in which the carbons were divided by gypsum ; (2) candles with carbons divided by kaolin. Bunsen's photometer was used. The following are the results :—

(1.) *Candles with Gypsum.*

Intensity of Light. (In Stearine Candles.)	Quantity of Revolutions per Minute of Machine.
931	1200
931	1350
1495	2500

(2.) *Candles with Kaolin.*

414	1224
402	1200
517	1222

These experiments show that it is better to divide the carbons of the candles by gypsum ; but it was also remarked that the light produced by candles with kaolin has more steadiness and is more agreeable. During these experiments one of Gramme's small magneto-electric machines was in use.

Prof. E. Schöne, of Moscow, has published two books containing numerous and valuable experiments on hydrogen peroxide, and on the occurrence of ozone and hydrogen peroxide in the atmosphere. Prof. Schöne comes to the following conclusions :—Sunlight accelerates the decomposition of hydrogen peroxide in aqueous solutions ; this compound is not an electrolyte. The reaction which takes place between ozone and hydrogen peroxide in the presence of water is the following :—

$$H_2O_2 + O_3 = H_2O + 2O_2.$$

The presence of ozone in the atmosphere cannot be strictly detected by Houzeau's or Schonbein's ozonometrical papers ; also the presence of ozone in the atmosphere is not ascertained, but hydrogen peroxide was found to be one of the normal constituents of the atmosphere. Experiments proved that in summer time the atmosphere contains a higher percentage of hydrogen peroxide than during the winter. The higher from the surface of the earth commences the condensation of the clouds the greater is the percentage of hydrogen peroxide in the air. Hydrogen peroxide combines readily with the peroxides of barium, sodium, and potassium, and yields compounds of the following composition :—

$$BaH_2O_4, Na_2H_4O_6, K_2H_4O_6.$$

During Schöne's experiments, all the year round, he found that 1 square metre of earth absorbs 110 milligrms. of hydrogen peroxide—a very small quantity indeed ; but when we remember that very small quantities of ammonia and nitric acid have an influence on vegetable life, we may also suppose that the hydrogen peroxide of the air also plays a necessary part in nature's economy.

S. KERN, M.E.

St. Petersburg.

NOTES AND QUERIES.

Oil for Leather.—Can anyone inform me of a good method whereby I can readily determine the quality of oil ; I may add that in my business cod oil is used to a large extent for what is termed 'buff leather."—T. P.

MEETINGS FOR THE WEEK.

MONDAY, May 6th.—Medical, 8.30.
— Royal Institution, 2. General Monthly Meeting.
— Society of Arts, 8, (Cantor Lectures). "Some Researches on Putrefactive Changes, and their Results in relation to the Preservation of Animal Substances," Dr. B. W. Richardson.

TUESDAY 7th.—Civil Engineers, 8.
— Zoological, 8.30.
— Photographic, 8.
— Royal Institution, 3. "On Some Points in Vegetable Morphology," W. T. Thiselton Dyer, M.A.

WEDNESDAY, 8th.—Society of Arts, 8. "The Phonograph, or Talking Machine," Mr. W. H. Preece.
— Geological, 8

THURSDAY, 9th.—Royal 8.30.
— Royal Institution, 3. "On Colour," Lord Rayleigh, M.A.
— Society of Arts, 8. (Chemical Section). "Some Recent Improvements connected with Alkali Manufacture," James Mactear.
— Mathematical, 8.

FRIDAY 10th.—Royal Institution, 8, Weekly Meeeting. At 9, "Effects of Stress on Magnetisation of Iron, Nickel, and Cobalt," Sir William Thomson.
— Astronomical, 8.
— Quekett Club.

SATURDAY, 11th.—Royal Institution, 3. "On Richard Steele," Prof. Henry Morley.
— Physical, 3.

Lately published, in one vol. of 1091 pages, with Diagrams and other Illustrations. 8vo. £1 11s. 6d.

EXPERIMENTAL RESEARCHES IN PURE, APPLIED, AND PHYSICAL CHEMISTRY.

By E. FRANKLAND, Ph.D. (Marburg), D.C.L., F.R.S., Professor of Chemistry in the Royal School of Mines, &c.

The work includes investigations on the Manufacture and Illuminating Power of Gas, on the Water Supply of Towns, and the Purification of Drainage from Towns and Manufactories.

Also by Professor FRANKLAND,

LECTURE NOTES FOR CHEMICAL STUDENTS. Second Edition. Vol. I. (Inorganic), 4s. Vol. II. (Organic), 5s.

London: J. VAN VOORST 1, Paternoster Row.

Now ready, Seventh Edition, with 98 Engravings, fcap. 8vo, 6s. 6d.

Practical Chemistry, including Analysis.
By JOHN E. BOWMAN.
Edited by CHARLES L. BLOXAM.
Professor of Chemistry in King's College, London.

*** In this edition the systematic course of Qualitative Analysis is arranged in a tabular form, and symbols and equations are largely used throughout the work.

J. & A. CHURCHILL, New Burlington-street.

Just published, 2nd Edition, 594 pp., 8vo., price 12s. 6d.

ORGANIC MATERIA MEDICA.
BY DR. MUTER.

Analytical Chemists will find this a concise and yet complete book of reference for the isolation and examination of the active principles of drugs. Special appendix on the microscopic characters of the starches in food and drugs. Copious index and qualitative courses for resins, &c.

Published by W. BAXTER at the Office of the South London School of Pharmacy, Kennington Cross, S.E., and sold by Messrs. Simpkin and Marshall and Messrs. Baillière, Tindal, and Cox.

Chemical Technology, or Chemistry in its Applications to the Arts and Manufactures. By THOMAS RICHARDSON and HENRY WATTS. Second Edition, illustrated ith numerous Wood Engravings.

Vol. I., Parts 1 and 2, price 36s., with more than 400 Illustrations.

Nature and Properties of Fuel: Secondary Products obtained from Fuel: Production of Light: Secondary Products of the Gas Manufacture.

Vol. I., Part 3, price 33s., with more than 300 Illustrations.

Sulphur and its Compounds: Acidimetry: Chlorine and its Bleaching Compounds: Soda, Potash Alkalimetry: Grease.

Vol. I., Part 4, price 21s., 300 Illustrations.

Aluminium and Sodium: Stannates, Tungstates, Chromates, and Silicates of Potash and Soda: Phosphorus, Borax: Nitre: Gun-Powder: Gun Cotton.

Vol. I., Part 5, price 36s.

Prussiate of Potash: Oxalic, Tartaric, and Citric Acids, and Appendices containing the latest information, and pecifications relating to the materials described in Parts 3 and 4.

BAILLIERE AND CO., 20, King William Street, Strand.

THE TELEPHONE.

Arrangements for Exhibiting or Fixing on application to EDWARD PATERSON, Telegraph Engineer, 3, Bedford Court, Covent Garden, W.C. Insulated Wires, Call-Bells, Insulators, and Galvanised Wire for Overhead Lines. Electric House-Bells, and all descriptions of Electrical Apparatus for experimental and other purposes. Price list post free 2 stamps.

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy. "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

---

JAMES WOOLLEY, SONS, & CO.
69, MARKET STREET, MANCHESTER,
DEALERS IN
CHEMICAL AND SCIENTIFIC APPARATUS
CHEMICAL REAGENTS, &c.,
FOR THE USE OF
ANALYSTS, SCIENCE TEACHERS, AND MANUFACTURERS

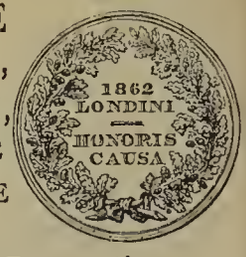
Price Lists on application

TO MANUFACTURING CHEMISTS AND OTHERS.

A Practical Chemist, of Swiss nationality and education, of experience in Germany and Switzerland in the production of artificial alizarin, anthrachinon, and cognate products, and of thorough knowledge of chemistry, will be open to accept employment in England in a few months as Chemist in a Chemical, Dyeing, or Printing Work.—Address, P 5, B. Wheeler, 4, Pall Mall, Manchester.

To be Sold, by Private Contract, an excellent and old-established Chemical Manufacturing and Drysalting Business, together with extensive works at Manchester, Glasgow, and Ayr. The business is a very lucrative one, and is in full working order. The sole reason for selling is the death of the last surviving partner. Only principals or their solicitors will be treated with.—Apply to Slater, Heelis, and Co., Solicitors, 75, Princes Street, Manchester.

BISULPHIDE OF CARBON,
PROTOSULPHATE,
RED OXIDE
OXYCHLORIDE
Sulphocyanide,
And every other Mercurial Preparation.

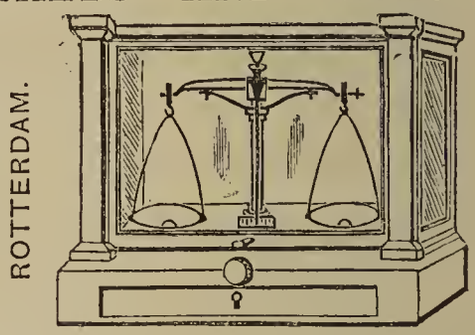


BISULPHITE OF LIME, TETRACHLORIDE OF CARBON
Oxysulphuret of Antimony, Glacial Acetic Acid,

LIQUOR AMMONIÆ,
SULPHIDE OF IRON,
PURE ACIDS,
CHLORIDE OF SULPHUR,
ACETONE,
CHLOROFORM,
ALDEHYDE,
CHLORATE BARYTA,
ARSENIC ACIDS,
FRUIT ESSENCES FOR CONFECTIONERY & LIQUEURS,
PERCHLORIDE OF IRON,
SULPHITE AND HYPOSULPHITE OF SODA,
PHOSPHATES OF SODA AND AMMONIA,
ETHERS,
BROMIDES,
IODIDES,
SCALE AND GRANULAR PREPARATIONS.

ALSO,
Pure Photographic Chemicals of every kind.
MANUFACTURED BY
WILLIAM BAILEY & SON,
HORSELEY FIELDS CHEMICAL WORKS,
WOLVERHAMPTON

BECKER & SONS,
MANUFACTURERS OF
CHEMICAL AND GOLD ASSAY BALANCES
AND OTHER
SCALES AND WEIGHTS.



BECKER'S STUDENT'S BALANCE, in polished mahogany glass case, sliding front, counterpoised, to carry 30 grammes in each pan and turn to ½ milligramme, nickel plated pans..£2 10
Ditto, ditto, in mahogany glass case, polished black £2 13

Sole Agents for England, Ireland, and Wales:—
TOWNSON & MERCER,

Becker's Complete Lists forwarded by post on receipt of 1d. stamp, or free on application.

BISULPHIDE OF CARBON,
CHLORIDE OF SULPHUR.

GAS PURIFICATION & CHEMICAL CO., LIMITED,
161, 162, 163, PALMERSTON BUILDINGS, LONDON, E.C.

THE NEW MINIATURE SPRENGEL PUMP.
(STEARN AND SWAN'S PATENT.)

As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

THE CHEMICAL NEWS.

VOL. XXXVII. No. 963.

PARAFFINS IN COMMERCIAL "WATER-GAS."

By HENRY MORTON, Ph.D., and WM. E. GEYER, B.S.

SOME experiments made by us with a "water-gas," as it is here technically called (*i.e.*, a gas made by mingling the products of the reaction of steam and carbon with oil-gas, or like products of the decomposition of petroleum or naphtha), led to the conclusion that this material contained some members of the marsh-gas or paraffin series, richer in carbon than marsh-gas itself. Such paraffins would, of course, play the part in such a gaseous mixture of practical illuminants, but not being absorbable by Nordhausen acid, would not be determined with the "illuminants" technically so called, in the usual process of gas analysis, and would be left to influence the results of those subsequent steps of the process which only contemplate the presence of free hydrogen and marsh-gas.

In looking about for suggestions as to the proper treatment of such a mixture, in order to make an analysis of the same, we found that little had been accomplished, and that that little was in some cases mixed with serious error.*

Even where the true conditions of the problem in certain cases are recognised, as in Bunsen's "Gasometrische Methoden," 1877, p. 249, and in Sutton's "Volumetric Analysis," 1871, p. 338, the case is not presented with the full generality of which it admits, and we have, therefore, thought it worth while to work out, and present a general discussion of the problem presented by the presence of a mixture of hydrogen, marsh-gas, and higher members of the marsh-gas series, in relation to the usual methods of eudiometric analysis.

In the first place the question presents itself—Can such a mixture be determined by any of the usual eudiometric methods?

Sutton and Bunsen state that a mixture of hydrogen and ethane may give exactly the same results as an equal volume of marsh-gas; but we may ask how extended is this possible ambiguity? Does it extend to any mixture of members of the marsh-gas series? Can even free hydrogen, as Fouqué supposes, be determined in presence of such a mixture?

To facilitate this discussion, we will, in the first place, present a table of the volumes of carbonic acid formed, of contraction produced, of oxygen consumed, and of water vapour developed by the explosion in the usual manner of several members of the marsh-gas or paraffin series.

For reasons which will presently appear, we include hydrogen in this table as the first of the series.

	H.	CH_4.	C_2H_6.	C_3H_8	C_4H_{10}.	C_5H_{12}.
CO_2 formed ..	0	1	2	3	4	5
Contraction ..	$\frac{3}{2}$	2	$\frac{5}{2}$	3	$\frac{7}{2}$	4
O consumed ..	$\frac{1}{2}$	2	$\frac{7}{2}$	5	$\frac{13}{2}$	8
H_2O formed ..	1	2	3	4	5	6

It will be noticed that in this table—

The CO_2 formed increases regularly by 1 from 0 upwards.
The contraction ,, ,, $\frac{1}{2}$,, $\frac{3}{2}$,,
The O consumed ,, ,, $\frac{3}{2}$,, $\frac{1}{2}$,,
The water formed ,, ,, 1 ,, 1 ,,

* See "Etude Chimique des cinq gaz des sources de pétrole de l'Amérique du Nord." Note de M. F. Fouqué. *Comptes Rendus*, Nov. 23, 1868, vol. 67, p. 1045. Also "Comp. of Natural Gas from Certain Wells in Western Virginia," by S. P. Sadtler. *Proc. Am. Phil. Soc.*, vol. xvi., pp. 2065 and 586.

The CO_2 formed by 1 volume of hydrogen, the first member of this series, is $0 = 1-1$; by the second member it is $1 = 2-1$; by the third it is $2 = 3-1$. By any other members represented by l, m, n, it will be $l-1$, $m-1$, and $n-1$, and so on.

The contractions produced by the various members will likewise be as follows:—

1st member $\frac{3}{2} = \frac{3+1-1}{2}$

2nd ,, $2 = \frac{3+2-1}{2}$

3rd ,, $\frac{5}{2} = \frac{3+3-1}{2}$

lth ,, $\frac{3+l-1}{2}$

mth ,, $\frac{3+m-1}{2}$

nth ,, $\frac{3+n-1}{2}$

The oxygen consumed will be, for the

1st member $\frac{1+3(1-1)}{2}$

2nd ,, $\frac{1+3(2-1)}{2}$

3rd ,, $\frac{1+3(3-1)}{2}$

lth ,, $\frac{1+3(l-1)}{2}$

The water formed will be, for the

1st member 1
2nd ,, 2
3rd ,, 3
lth ,, l.

If then we express by x, y, z, &c., the respective volumes of any number of such constituents in a mixture of gases and vapours in which they occur, they being respectively the lth, mth, nth, &c., orders of the series C_nH_{2n+2}, and indicate by V the total volume of the mixture, by C the volume of carbonic acid formed, and by A the contraction after explosion, by O the oxygen consumed, and by W the water vapour formed, we shall have—

$$x+y+z+ \ldots\ldots\ldots\ldots = V \quad (1)$$

$$(l-1)x+(m-1)y+(n-1)z+ \ldots\ldots\ldots = C \quad (2)$$

$$\left(\frac{3+l-1}{2}\right)x+\left(\frac{3+m-1}{2}\right)y+\left(\frac{3+m-1}{2}\right)z+ \ldots = A \quad (3)$$

$$\frac{1+3(l-1)}{2}x+\frac{1+3(m-1)}{2}y+\frac{1+3(n-1)}{2}z+ \ldots = O \quad (4)$$

$$lx + my + nz + \ldots = W \quad (5)$$

From equations (2) and (3) we obtain by clearing (3) of fractions—

$$(3+l-1)x+(3+m-1)y+(3+n-1)z+ \ldots = 2A,$$

subtracting (2) and dividing by 3 we get—

$$x+y+z+ \ldots = \frac{2A-C}{3}, \quad (6)$$

an equation identical with (1), and therefore showing that the results are indeterminate.

If we resort to equations (4) and (5) the results are in all respects as unsatisfactory as with equation (3). Thus from twice equation (4) subtract three times equation (2)

$$\begin{array}{r} [1+3(l-1)]x+[1+3(m-1)]y+[1+3(n-1)]z = 2O \\ 3(l-1)\,x+\quad 3(m-1)\,y+\quad 3(n-1)\,z = 3C \\ \hline x+\qquad\qquad y+\qquad\qquad z = 2O-3C \end{array} \quad (7)$$

Equation (7) like equation (6) is identical with (1). Again, from (5) subtract (2). We have—

$$\begin{array}{rrrrl} lx+ & my+ & nz+ & \ldots & =W \\ (l-1)x+ & (m-1)y+ & (n-1)z+ & \ldots & =C \\ \hline x+ & y+ & z+ & \ldots & =W-C \end{array} \quad (8)$$

which is also identical with equation (1).

From all this it follows, that in the case of any one of these gases, or in the case of any mixture of any number of them, the following relations will hold—

$$V=\frac{2A-C}{3}=2O-3C=W-C=\frac{3W-2O}{2}=\frac{2A-W}{2}.$$

The above considerations have acquired a certain amount of practical importance from the presence of these paraffins, as above mentioned in the commercial products, known as "water-gas," which are now being manufactured on a large scale in several places, and which have thus come under the hands of chemists for examination and analysis.

As a preliminary method for obtaining at least an approximate determination, we had resort to the absorption of these substances in absolute alcohol, as noted by Sutton, "Vol. Anal." p. 323, and in Watts's "Dict. of Chem." vol. i., p. 286.

In place, however, of allowing for the added tension of the alcohol vapour, we removed it by absorption with Nordhausen acid. We also made allowance for the solution of hydrogen, marsh-gas, and carbonic oxide in the alcohol employed.

By these means we obtained such results as the following.

"Water-gas" made by the Municipal Company of New York,* working under the Tessié du Motay patents :—

Carbonic acid	18·050†
Oxygen	
Olefines	
Carbonic oxide	26·790
Marsh-gas	21·646
Hydrogen	27·897
Nitrogen	4·243
Paraffins	0·702
	99·328

An analysis of the same gas made in the usual way gave the following result :—

Carbonic acid	0·327
Oxygen	0·561
Olefines ("illuminants")	16·323
Carbonic oxide	27·337
Marsh-gas	25·985
Hydrogen	24·889
Nitrogen	4·572
	99·994

The difference between these analyses in the values assigned to hydrogen and marsh-gas are (other errors excepted) due to the presence of the 0·7 per cent of "paraffins."

If we assume the average composition of these paraffins to approach that of propane, this would just about account for the discrepancy.

When the gas was passed for an hour in a slow stream through a quantity of absolute alcohol, this yielded on boiling about 30 per cent of gas not absorbable by bromine, chloride of copper, pyrogallic acid, or caustic potash, and which, when treated with absolute alcohol was, in part, absorbed in a very high ratio, the first dose of alcohol dissolving about six times its volume. The alcohol from which this gas had been driven off by boiling, on dilution with water, became cloudy, and on standing threw up an oily layer, which had an odour resembling that of allylene and crotonylene.

It thus appears evident that members of the paraffin series, pretty high in the scale, were present, and that the supposition that their average composition was about that of propane is highly probable.

The treatment with alcohol and subsequent manipulation and calculations require much time, and of course only yield approximate results, but they at least show, what is of considerable practical importance, that the amount of these paraffins is small, and that the ordinary methods do not involve errors practically important under the existing conditions.

Another variety of water-gas, made at Harrisburg, Pa., under the Lowe patent, gave the following results under the two methods of treatment :—

	Usual method.	With alcohol.
Carbonic acid	3·403	3·402
Oxygen	0·340	Trace
Olefines	11·782	12·828
Carbonic oxide	27·216	25·233
Marsh-gas	21·740	21·699
Hydrogen	32·567	34·548
Nitrogen	2·945	1·408
Paraffins	Not estd.	0·869
	99·993	99·987

The specimens here examined, though collected on the same occasion, do not appear to be actually identical. In fact, the holder used at these works is so small that it has to be re-filled several times in the 24 hours. This is probably the reason for the less complete accordance with theory observed in these two analyses, if assumed to be made from an identical mixture.

ON DYER'S CHEMICALS.

By J. MARZELL.

(Continued from p. 146.)

NAPHTHALIN, $C_{10}H_8$.

RESPECTING the quantity of naphthalin yielded by coal-tar there is very little to say, as the few notes relating to it generally refer only to certain tars, got at certain times and according to certain methods, and therefore of very limited or no use for us. Some definite results, however, are shown by Crace-Calvert's careful researches, who puts up the following numbers :—

Cannel coal yields about	15	per cent naphthalin.
Newcastle coal yields about ..	58	,, ,,
Staffordshire coal yields about..	22	,, ,,

Contrary to the conditions of formation of benzol, the tar is the richer in naphthalin the higher the temperatures used in the gas-works, which is easy to understand in looking at the circumstances of its formation. Already, in 1858, H. Schwarz* gave the opinion that the naphthalin might be a product of decomposition of benzol, as follows :—

$$\underbrace{2C_6H_6}_{\text{Benzol.}} = \underbrace{C_{10}H_8}_{\text{Naphthalin.}} + \underbrace{C_2H_4}_{\text{Ethylen. (Light Gas.)}}.$$

* It may be of interest to note that the details of the process here mentioned are as follows :—Superheated steam is passed, for about ten minutes, into a "gasogen," or cupola furnace, previously brought to a state of intense ignition by a blast of air; and the mixture of hydrogen, carbonic oxide, and a little carbonic acid, &c., generated, is cooled, purified by lime, and stored in a small gas holder.

When the steam jet has cooled the cupola beyond the proper point, it is shut off, and the air blast renewed for about an equal time, during which the products of combustion escape into the air; the steam is then again turned on, and so the processes are alternated.

From the small holder the gas passes through a set of carburetters, where naphtha is continuously run over iron shelves in face of the flowing gas, and the whole apparatus is maintained at a constant temperature by a steam jacket. The gas thus saturated with naphtha-vapour, is then run through retorts, kept at a very high temperature, where it is fixed, *i.e.*, where the naphtha-vapour is split up into "olefines" (technically so-called), marsh-gas, and hydrogen. It then passes into the storage-holders and is ready for distribution.

† The proportions of these several constituents not being in question, they were not separately determined to save time.

* *Dingler's Journal*, cxlvii., 229.

And ten years afterwards the brilliant synthetical works of Berthelot rendered it certain that the naphthalin is simply a derivative of benzol.

$$\underbrace{C_6H_6}_{\text{Benzol.}} + \underbrace{C_2H_4}_{\text{Ethylen.}} = \underbrace{C_8H_8}_{\text{Styrol.}} + \underbrace{2H.}_{\text{Hydrogen.}}$$

$$C_8H_8 + C_2H_4 = \underbrace{C_{10}H_8}_{\text{Naphthalin.}} + 4H.$$

$$C_6H_6 + \underbrace{2C_2H_2}_{\text{Acetylen.}} = C_{10}H_8 + 2H.$$

$$C_8H_8 + C_2H_2 = C_{10}H_8 + 2H.$$

*The Manufacturing Process.**

The methods indicated by Laurent are merely of historical interest in the present state of tar distilling. A method still in use in many of its points is the following:—That part of the coal-tar solidifying in the cold on account of its containing naphthalin is allowed to stand for six or eight days. The fluid part is then taken off, the crystals smashed to a paste, from which the oil is taken out by means of a centrifugal machine, and finally by hydraulic pressure. The resulting residue of crude naphthalin is melted and mixed with some per cents of caustic soda lye. The tanks used for that are made of iron, and provided either with a steam-jacket, or, better, with a system of steam pipes lying on the bottom. The naphthalin is put in, melted, and then the caustic soda is added with well stirring. It is advisable to wash two or three times with soda, taking off the top-liquor each time. After that, washings with hot water have to be continued to entire neutralisation or till red litmus-paper is no longer coloured blue. By the alkaline soda the tar-acids are removed.

The so-far purified liquid naphthalin is well mixed with some per cents of sulphuric acid (brown will do, but it is better to use acid of 1·840 sp. gr.) the supernatant acid liquor is taken off, and the remaining naphthalin is washed till it is quite neutral. Afterwards a quantity of a strong caustic soda-lye is added, well mixed, and the whole allowed to stand quietly for two or three hours at 100° C.

The naphthalin whilst fluid is let into stills, and driven over by means of open fires. The stills are either of wrought- or cast-iron; those containing 200 to 250 gallons have yielded good results. At the beginning, the distillate is mixed with small quantities of water; but at about 210° C. a continual stream of naphthalin comes over, and that so quickly that in twenty minutes 1 cwt. of naphthalin can be easily obtained. Great care has to be taken in keeping the water in the condenser always at 80° C., as otherwise, by solidifying, the naphthalin would stop up the coil. The receiver is of iron, with a cover, and provided with a man-hole, and stands in a steam-bath, which allows a temperature of about 80° C. to be maintained, and the naphthalin to be kept in a liquid state. Hence the pure naphthalin is run into moulds of glass, iron, or wood (the latter has to be moistened first), and allowed to solidify. Usually it is cast in the form of bricks.

As soon as the temperature in the still has risen to 230° to 235° C. the distillate becomes yellow, and is mixed with many oily impurities. As soon as that occurs the receiver has to be changed, and the now coming over distillate is added to another charge for re-distilling.

The naphthalin resulting from this method is in the form of a mass of white crystals showing a spiral structure.

A method offering much advantage is the extraction of the naphthalin from the last parts of the "light oils." Respecting the working-up of the "light oils," it may be remembered that after the extraction of carbolic acid and its homologues by treating with caustic soda solution the oils are submitted to re-distillation. That part going over till about 200° C. (called "crude naphtha," showing a specific gravity of 0·93 = 10° under proof = 13 to 14° Tw.) is put to the "first runnings" to be washed and re-distilled with them, whilst everything passing between that point and a specific gravity below 1·00 (till a sample thrown into water sinks down) is put to the next lot of "light oils" for refining. The remaining residue, varying between 25 to 50 per cent of the whole charge, is usually put to the "creosote oils." But if instead of that the distillation is pushed forward, the distillate soon solidifies in the receiver to a white paste of naphthalin crystals. On submitting this product to hydraulic pressure naphthalin is obtained quite pure and white. If it retains traces of oils it gets red in contact with the air, and therefore the pressure has to be carried through with great attention. In case the utmost purity is wanted, by washing with alcohol the last impurities can be taken away, the spirit being easy to separate from the higher boiling oils. In this method advantage is taken of the treating with caustic soda for the purpose of taking out the tar-acids. It acts in a similar way as in the method already described of washing with soda.

To examine a product of distillation for naphthalin, the substance is treated with fuming nitric acid, the resulting nitro product is washed with water to perfect neutrality, and then put into a boiling mixture of 1 part of K_2S to 1 part of KOH (caustic potash). In case naphthalin is present, a splendid violet-blue colour will be observed.

For purifying sufficiently for the purpose of bringing the naphthalin into a form in which it can easily be attacked by any reagents, sublimation is used with great advantage.

An impure red naphthalin can be got in white leaflets if it is mixed with quartz-sand and submitted to a slow sublimation on the water-bath. The quartz acts as a filter in this way, keeping back the higher boiling impurities.

The naphthalin fusing at 79° C. sublimes very easily, and without any great loss by carbonisation, &c. The most simple way, and one which can be used with great advantage for the production of limited quantities of naphthalin is the following:—The apparatus consists of a cast-iron pot of about 4 ins. internal diameter by 3 ins. internal diameter, set in brick-work, having a fireplace beneath, but with an arrangement that the flame cannot play directly on the vessel. As receiver, a common cask of about 5 feet in height by 4 feet internal diameter can be taken, which is put over the opening of the iron pot, and rests on the stone plate covering the hearth. At the upper end a small hole allows the non-condensed vapours to escape. It is useful to provide the cask with a lifting-screw, so that after the operation is finished, the receiver with the sublimate can be moved about without shaking. The pot is filled, the fire lighted, and then the cask put on. The rising vapours are condensed into the receiver, and settle into a thick crust of white naphthalin on the walls. Great attention has to be paid to the fire, and it is a point of importance always to keep the lowest temperature possible. It is clear that at a higher heat the receiver itself gets warm and cannot act as condenser, and the consequence will be that the naphthalin vapours will melt and run back into the pot.

The inconvenience of working with the small cask, if the produce is large, soon led to the improvement of subliming chambers. They represent large rooms built of bricks, the walls often lined with wood on account of cleanliness. In the ceiling there is usually a small tower-like addition, shut loosely by a wooden flap-valve, which in case of an explosion, or even pressure inside the chamber, can easily be thrown open by the vapours or gases, thus allowing a way of escape. At the side opposite the inlet-pipe there is a wooden door by which the chamber can be emptied after the operation is over. The subliming-pot is of the same shape as before, but shut by means of a cover, which is fastened by screws, and provided with a man-hole. A 3 inch pipe effects the communication with the chamber. The retort is often lined with Chamotte to prevent destroying and coking by direct

* Vohl, *Dingler's Journal*, clxxxvi., 138; Lunge, Theer Distillation, Braunschweig, 1869.

contact with the hot iron: sometimes an oil-bath is preferred for the same reason. It is needless to say that here also the temperature has to be kept at the lowest point possible, to prevent a distillation taking place instead of a sublimation. The vapours enter the chamber, and are condensed at the cold walls and at the bottom. The operation being finished—that is to say, the number of pots calculated for one charge of the chamber being driven over—the door of the chamber is opened, and the sublimate scraped out. The utmost attention has to be paid to the rule never to open the man-hole of the pot and the door of the chamber at the same time, as by the resulting air-currents an explosion of the hydrocarbon vapours may take place very easily, although, of course, not to the same extent as with bodies fusing and subliming at a higher temperature than naphthalin. But as the subliming apparatus in most cases is used for other hydrocarbons (*e.g.*, anthracen, phthalic acid, &c.), it is advisable to fix the rule above mentioned for every operation with the sublimer.

To quicken the operation, or to withdraw the rising vapours immediately from the pot, two methods are adopted—(1) To draw them out by means of a ventilator; or (2) to blow them out by superheated air or steam.

In the first case centrifugal ventilators, acting as suckers, are used (generally a paddle-wheel, the three-bladed wheel of Tabry's or the silent fan of Schiele, which perfectly answer the purpose), The ventilator is of wood, and although the diameter is easily found out by mechanical calculation, the velocity of rotation has to be found out by experience and practice. Another action of the ventilator is the creating and maintaining of a vacuum, owing to which the naphthalin, submitted to a lower pressure of air, sublimes more easily and at a lower temperature. The ventilator is put up inside the chamber fronting the end of the inlet-pipe. To fix it in the pipe itself would not be practical, as it would cause stopping, &c.

As to the blowing out of the vapours by means of superheated steam or air, this method is usually employed. In using air precaution has to be taken first to free it from oxygen. The operation well conducted, so that the heat is not too high,– scarcely more than 100° C. are wanted—and the condensation proceeding well no pressure or superheating of the vapours is caused. There is no fear of oxidation with the oxygen, but it is better to provide for all contingencies, and not to risk the apparatus and all by a wrong economy. For the blowing in of air, ventilators of the most simple construction generally answer the purpose. A certain pressure is necessary, but an excess would only interfere by blowing out the melted and non-melted contents of the retort. Practice will very soon teach the right point. Between the ventilator and the retort a system of iron pipes is interpolated, laying in an oven, and filled with charcoal. By making them red-hot, and forcing the air through, all the oxygen will be burnt to CO and CO_2, and thus made harmless. It is not to be forgotten that by the expansion caused by the superheating the pressure of air rises considerably. The iron pipes in the superheater have to be made thick and strong, as by a crack the pressure of air, finding another outlet, would be weakened a good deal. The conducting-pipe from the deoxidiser to the pot is of about ½ inch, and ends below the surface of the cover just inside the pot. To bring it right into the stuff itself and so effecting a stirring at the same time is not advisable, as a continual nuisance by stopping, &c., would arise. Besides the outlet-pipe, there is another short pipe of about ¾ inch, provided with a cock. It serves to examine from time to time the inside of the pot, whether the stuff is melted and whether it is blown out, whether there is pressure enough on, too much, or too little, &c. The pot is charged through the man-hole, the fire put on, and as soon as the naphthalin is fused the air admitted.

If instead of air steam is used, the deoxidiser is changed to a superheater, the steam being supplied from the next steam-boiler. The pipes are stronger than those used before, and have to be calculated for standing a high pressure. In the chamber an arrangement is made to precipitate the entering naphthalin vapours by a fine shower of cold water, and in this case the bottom is changed into a filter. The filter-cloth can be of any material (linen, wool, or cotton), as the naphthalin is usually quite neutral or only very slightly acid, if the purifying (washing) process has not been carried out carefully. This arrangement allows the taking of chambers of far smaller dimensions than would be necessary with the methods above described, where the vapours have to condense themselves. The naphthalin taken out of the filter-chamber in the form of a white loose mass of leaflets has to be brought into drying-rooms heated by steam. It would seem practical to submit the naphthalin at first to a hydraulic pressure; but in most cases that cannot be done, as instead of a loose sublimate the naphthalin is got in lumps, which even by a very careful powdering does not assume the advantages of a sublimate.

As to the pot used in both cases—working with air or steam—it is commonly, as above described, lining the inside with Chamotte, immersing the pot in an oil-bath, and other precautions against injury, &c., vary with nearly every works. Instead of putting the stuff into a pot deeper than wide, with great advantage flat apparatus have been introduced. They are set in an oil-bath, and the stuff is spread in thin layers over a kind of hurdle inside the pot, so as to offer a great surface, and not being in direct contact with the walls. The steam is introduced either from above or from the bottom, blowing upright in the latter case. Sometimes a combined action of ventilator and injector is found useful.

For a mere sublimation of naphthalin nobody, of course, would put up so complicated a plant as the last ones described; but as in most cases the sublimer is used for other materials as well, I thought it might perhaps be of some interest to many of the readers of the Chemical News to have a description, even only in a few words, of the subliming apparatus as used in chemical works with good results.

(To be continued)

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, May 2, 1878.

Dr. J. H. Gladstone, F.R.S., President, in the Chair.

After confirmation of the minutes, &c., the names of the following candidates were read for the first time; E. R. Budden, A. A. Drinkwater, and J. Collins.

The President then called on Mr. Sidney H. Vines to deliver his lecture "*On the Chemical Aspects of Vegetable Physiology.*" The investigation of substances which occur in the cells of plants has for a long time formed a favourite theme for chemists, whilst the decomposition of these substances has added largely to our knowledge of chemistry. It is strange that but few researches have been made in the direction of determining the reason of the occurrence of these substances and the part that they play in the economy of the plant. One of the most typical of these substances is chlorophyll. Chlorophyll, which occurs in nearly all plants, is essential to the function of assimilation, *i.e.*, the decomposition of carbonic acid and the formation of starch in the cell, this process being accompanied by the liberation of oxygen. As early as 1690 it was observed by a French botanist that bubbles of gas were given off by green leaves submerged in water; it was next noticed that if the water had been previously boiled no gas was evolved. Priestley found that the gas given off by leaves in sunlight was of

a "purer and better nature," *e.g.*, air which could not support combustion could be so purified by introducing a green plant and exposure to sunlight as to be again capable of supporting life and combustion. The next point noticed was that some sort of proportion existed between the amount of "fixed air" (CO_2) present and the "dephlogisticated air" given off. De Saussure then observed that this process was accompanied by an increase of weight in the plant. Our knowledge of the subject remained at this point till about 1837, when the circulation of starch granules was discovered and their development studied. Sachs next took up the subject and proved that starch grains were not formed in plants which are bleached from the absence of light, and that their formation in the chlorophyll corpuscles depended on the exposure of the plant to bright sunlight. Godlewski proved that if no carbonic acid was present no starch grains were formed. So we have two sets of phenomena, namely, the evolution of oxygen with absorption of carbonic acid, and the formation of starch, for both of which three conditions are essential, viz., sunlight, chlorophyll, and carbonic acid. So we may justly conclude that the two sets of phenomena belong to the same function. Starch is not the only product of this assimilation. In the onion we find no starch, but in its place another carbohydrate grape sugar. Some experiments of Briosi, which seemed to show that substances other than carbohydrates are formed—*e.g.*, oil drops—have been lately disproved by more exact observations of Godlewski. So that as far as we know the only substances formed as a consequence of assimilation are carbohydrates, and to their formation, therefore, the increase of weight of the plant is due. De Saussure found that a plant increased in weight 531 grms., whilst the carbon in the carbonic acid was 217 grms. These numbers fairly correspond with the increase supposing the carbon to unite with hydrogen and oxygen to form starch; thus—$C_6H_{10}O_5 = 162$ to $C_6 = 72$. The next points are—What is the function of chlorophyll, and what part does it play in the formation of starch? As regards the composition of chlorophyll we have but little information. There are at present several distinct views as to its proximate composition; one that it is a definite and distinct chemical entity; the second, that it is a mere mixture of colouring matters, or rather of two groups of colouring matters, one group being blue and to which the name cyanophyll is applied, the other is yellow and is termed xanthophyll. Another view, supported by Pringsheim, Karl Kraus, &c., holds that chlorophyll is nothing less than the cyanophyll of other observers, whilst the xanthophyll is a distinct substance which is a product of the degradation or formation of chlorophyll, but forms no integral part of it. The same diversity of evidence prevails with the ultimate constitution of chlorophyll; according to Pfaundler it contains 0·37 per cent N, other results give 7 per cent, whilst a Russian observer, Timiriazoff, believes it to be an ammoniacal compound, and has called it chlorophyllin. One point seems to be agreed upon by all observers, viz., that it contains iron in its molecule. The opinions which prevail as to its action are various. Wiesner thinks that the growing cells absorb CO_2 from the air, that the chlorophyll combines with the O, whilst CO unites with the elements of water to form carbohydrates. The chlorophyll in its turn is deoxidised, and the oxygen thus set free evolved by the plant. So that according to this view chlorophyll acts as a carrier. Karl Kraus suggests that the process is one of reduction and that chlorophyll is formed by the combination of a substance, leucophyll (for whose existence there is no experimental evidence), with the products formed by the reduction of the carbonic acid absorbed from the air. The chlorophyll is then split up by the action of light into leucophyll and other bodies, the latter forming starch; the leucophyll re-combines, and so the process goes on continuously. According to Sachse, chlorophyll is a product of assimilation, and by the further action of light is converted into starch. By the action of purpurol on resorcin colouring matters more or less remotely resembling chlorophyll have been formed. It is known, moreover, that carbohydrates can be oxidised into aldehyds and aromatic substances. From some experiments of Karl Kraus it is probable that some substance resembling an aldehyd exists in seedlings, while Gorup-Besanez has detected pyrocatechin in plants; some results of Karl Kraus seem to show that in seedlings an aldehyd and an aromatic substance unite in the dark to form ætiolin, but in the light to form chlorophyll; so that on the whole there is some foundation for the theory of Sachse, which may be summed up thus:—That seedlings have the power of decomposing their stored up carbohydrates, forming acids and aromatic substances; the former are reduced to aldehyds, uniting with the latter to form chlorophyll (and in the dark ætiolin), the ultimate product being again starch. If we trace out the probable destiny of the carbohydrates we find that one portion is used to build up the vegetable cell wall, and is there deposited as lignin, &c.; a second part combines with nitrogen to form protein, but of the seat of formation of this protein we have no idea; whilst a third portion is decomposed into chlorophyll for the newly formed parts of the plant. If any excess remains it seems to be stored up for another year. The Lecturer then concluded this portion of the subject, merely pointing out how much remains to be done before conclusions can be arrived at with any certainty.

In the second part of the lecture Mr. Vines considered the origin of vegetable acids and their bearing on the first part of his discourse. Liebig and Mulder from observations on the ripening of fruits came to the conclusion that acids were the first products of assimilation, and from these the carbohydrates were formed. This theory breaks down under the test of experiment, and then the question arises by what process are the acids formed in the plant if not by assimilation? Hoppe-Seyler by the decomposition of sugar with alkalies in the absence of air has produced formic acid and pyrocatechin. Karl Kraus has observed in the onion, which contains much grape sugar, that from the external dry scales much pyrocatechin can be obtained; these dry scales also have deposits of calcium oxalate, whilst the internal scales contain only sugar, so that here the sugar is decomposed into an oxalate and an aromatic substance. In the germination of leguminous plants a substance occurs, asparagin, which has much significance in vegetable physiology. It has been found that in the germination of the leguminosæ the amount of nitrogen in the seed does not vary; the nitrogenous substance of the seed is oxidised into asparagin with the evolution of CO_2. If the germination is in the dark the asparagin accumulates, but when the plant is exposed to light the asparagin disappears and the plant forms carbohydrates. It has been suggested that asparagin is formed by some process analogous to that of digestion. It is known that some seeds contain a peptic ferment, and that aspartic acid is formed when gluten is digested by the pancreatic ferment, so that the suggestion is not without some foundation. The Lecturer concluded with some remarks as to the proximate composition of seeds, about which much uncertainty exists. It is stated that seeds contain much legumin. By some of Hoppe-Seyler's pupils legumin is said to be a sort of globulin. The solanin from potatoes is now believed to resemble asparagin rather than belong to the alkaloid family. Chenopodin from the chenopodium has been said to be identical with leucin. In concluding, the lecturer said that his principal objects had been to sketch the points of contact between vegetable physiology and chemistry, and to point out the sort of information which the vegetable physiologist was most desirous of obtaining from the chemist.

The President said that in listening to the Lecturer three points had especially attracted his notice—(1) That the subject of vegetable physiology was of great interest from a chemical point of view; (2) that the subject was one of which the Fellows very rarely heard anything;

and (3) the very great clearness and ability with which Mr. Vines had introduced and handled the subject.

Dr. Gilbert could but agree with the President in thanking Mr. Vines for his lucid account of what is known, as well as for showing us our lack of knowledge, and indicating to us the lines of work which it was specially necessary to follow up. Mr. Vines, though principally directing his attention to the assimilation of carbon, had not omitted to refer to the assimilation of nitrogen, which from one point of view was even of greater importance. If he might suggest a line of research which would be of the utmost importance to agriculture, as well as interesting to the vegetable physiologist, he would recommend an investigation, especially as regards nitrogen, in plants, from the seed upwards, belonging not only to the Leguminous order, but also to some widely different order, *e.g.*, a Gramineous plant.

Mr. Kingzett could but notice how much speculation existed in the various theories which had been brought before the Society. In his opinion much might be learned by studying the products of chlorophyll when acted on by different reagents. He also called attention to the great want of analytical data in the papers of Hoppe-Seyler's pupils which Mr. Vines had referred to.

Prof. Thistleton Dyer pointed out that for the study and elucidation of these processes all the delicacy of the histologist and all the analytical skill of the chemist were required. The subject could either be investigated by the vegetable physiologist from a morphological aspect, or by the chemist who concentrated his attention on the products of the machine. The latter investigator was sometimes too apt to consider vital products as substances which could be split up by reagents. This method, although giving us much information as to the substances when dead, often furnished us with but little knowledge of their condition when alive. Some substances which were of the greatest importance to the chemist, &c., were of little interest to the vegetable physiologist, and were viewed by him as mere excretions. Thus, the cinchona alkaloids seemed to be merely casual secretions in the bark of some plants, and if the bark containing all these valuable alkaloids were removed the plant seemed none the worse. The great problems are—How does a plant get its living? and how does it assimilate its food? It seemed to the speaker that chlorophyll brings up vegetable life to a point where fungoid growth starts. Thus, if we cut through the stem of a tree we find the outside parts green, the inside parts white, and feeding on the nourishment afforded by the external layers.

Prof. Church said that mucilage was transformed in a manner similar to starch. This was proved by experiments with the seeds of the flax plant, which contain mucilage but no starch.

Mr. Vines, in reply, thanked the Society for the kind interest with which they had listened to his lecture, and reiterated his desire for the cordial co-operation of the chemist and the vegetable physiologist. With reference to Mr. Kingzett's remarks as to speculation, he would only say that the vegetable physiologists would be only too glad to build their theories on more facts when the chemists furnished them.

After a vote of thanks to Mr. Vines for his lecture, the Society adjourned to May 17, when the following papers will be read:—"On a Method of Determining High Boiling-points," by Messrs. Carnelly and Carleton Williams; "On Sage-Oil," by Messrs. Muir and Suguira; "On High Melting-Points," by Dr. Carnelly.

Influence of Plants in Rooms.—"The hygienic influence of plants in rooms" forms the subject of a special chapter, which has been written for the forthcoming illustrated edition of Mr. Francis George Heath's "Fern Paradise"—a "Plea for the Culture of Ferns."

TYNE CHEMICAL SOCIETY.

*Inaugural Address,**

By John Affleck, M.A., D.Sc., President.

Sulphuric Acid.

(Continued from p. 171.)

3. *Calculation of Acid Productions.*—Notwithstanding the apparent simplicity of the thing, and the confident way in which it is often spoken about, it is really difficult to ascertain very accurately, by measurement, the quantity of O.V. made. One part of the difficulty arises from the chambers being such large and shallow reservoirs, that the smallest error in gauging the depth, either from inaccuracy of observation or from the chamber floor being out of level, will affect the cubical measurement very considerably. Another is due to the fact that the acid on the floors varies in strength from one point to another, rendering it next to impossible to draw a sample of the true average strength from the chamber. These errors, due to stock-taking, no doubt, become of small moment when the production is taken over a longer period, though they often make sad havoc of the weekly returns.

But the main source of the difficulty remains. All the acid run from the chambers may be very correctly measured and sampled in proper cisterns, but it has then to be calculated into O.V.

Here the discrepancies of the different tables used by manufacturers come into play; while their methods of applying the figures they find in their tables to the purpose in hand are also so various that it would be difficult to get any three acid makers, from different works, to agree as to the O.V. contents of a cistern full of acid.

It follows that, until some more uniform and accurate means of calculating O.V. by measurement is generally adopted, it is well to control the usual returns by some other method. The sulphate made from a ton of pyrites is a thing very easily found by taking the most ordinary care and precautions; and this is a figure which should appear in the produce sheet of every alkali works, as showing the economy of material in the whole salt cake process. But, strictly speaking, it gives only negative information about the chamber working. When *high*, it proves that the chambers cannot be doing bad work; but when *low*, it may be, *not* because *less* acid is being made from the pyrites, but because *more* of it is wasted in decomposing the salt.

Hence the importance of determining the loss of sulphurous acid in the waste gases of the chambers, as a check upon the acid produced by measurement. Mr. Mactear, of Charles Tennant and Co., in a very able and interesting paper read before the Newcastle Chemical Society, in March last, has treated this subject in a most exhaustive manner. The paper being in the hands of most of you, I need not describe the apparatus he has devised for continuous testing of the waste gases. It is fitted up in very fine style at the Hebburn Works, where it is constantly in use, and, I am sure, Mr. Stuart will be very happy to show it to any of you.

In showing how, by means of the percentage of oxygen in the waste gases, the quantity of sulphur found to be escaping, per cubic foot, is to be calculated into the percentage on the total sulphur, Mr. Mactear has involved himself in unnecessary complications in the calculation. He estimates first, the nitrogen due to the combustion of one ton of pyrites; from that, by the help of a constant depending on the percentage of oxygen in the escaping gases, the air associated with that nitrogen; and, by adding the two together, obtains "the total volume of residual escaping gases from one ton of pyrites."

Now it appears to me to be a much simpler way to start with the percentage of oxygen in the waste gases, as

* Delivered October 12, 1877.

given by experiment, and denoting that varying quantity by a general expression (say V), to work backwards, step by step, till a formula is got for the "total sulphur," or "sulphur burnt" per cubic foot of the escaping gases. Thus:—

Let V = vol. per cent of oxygen in escaping gases. Then per cub. ft. of escaping gases at ordinary temperature and pressure (760 m.m., 15·5° C.). Oxygen fixed in kilns and chambers will be—

$$\frac{1728}{79\cdot2} \times (20\cdot8 - V) \text{ cubic inches.}$$

or—

$$\frac{1728}{79\cdot2} \times \frac{273}{288\cdot5} \times (20\cdot8 - V) \text{ cub. inches at 760 m.m. and 0° C.}$$

One litre oxygen at 760 m.m. and 0° C. weighs 1·430 grms., and 1 litre is equal to 61·02 cubic inches; therefore the above volume of oxygen would weigh—

$$\frac{1728}{79\cdot2} \times \frac{273}{288\cdot5} \times \frac{1\cdot430}{61\cdot02} \times (20\cdot8 - V) \text{ grms.}$$

Assuming sulphur in pyrites to exist as FeS_2 and perfect oxidation to take place, 1 part O burns 1 part FeS_2, or 0·533 part S; therefore "sulphur burnt" by above weight of oxygen, and corresponding to one cubic foot of waste gases,

$$= S_1 = \frac{1728}{79\cdot2} \times \frac{273}{288\cdot5} \times \frac{1\cdot43}{61\cdot02} \times 0\cdot533 \times (20\cdot8 - V) \text{ grms.}$$

$$= 0\cdot257885\ (20\cdot8 - V) \text{ grms.}$$

Or, assuming that "sulphur burnt" is to "total sulphur" as 45 : 47·5; "total sulphur" per cubic foot of waste gases will be—

$$= S_2 = 0\cdot257885 \times \frac{47\cdot5}{45\cdot0} \times (20\cdot8 - V)$$

$$= 0\cdot272212\ (20\cdot8 - V) \text{ grms.}$$

From these formulæ I have calculated for use the following table, showing for each value of V, from 5 to 15, both the "sulphur burnt" and the "total sulphur" in grms. per cubic foot of the waste gases.

Vol. of Oxygen in Waste Gases.	"Sulphur Burnt" per c. ft. of ditto.	"Total Sulphur" per c. ft. of ditto.
5 per cent	4·0746 grms.	4·3009 grms.
6 ,,	3·8167 ,,	4·0287 ,,
7 ,,	3·5588 ,,	3·7565 ,,
8 ,,	3·3009 ,,	3·4843 ,,
9 ,,	3·0430 ,,	3·2121 ,,
10 ,,	2·7852 ,,	2·9399 ,,
11 ,,	2·5273 ,,	2·6677 ,,
12 ,,	2·2694 ,,	2·3955 ,,
13 ,,	2·0115 ,,	2·1232 ,,
14 ,,	1·7536 ,,	1·8150 ,,
15 ,,	1·4957 ,,	1·5788 ,,

With this table nothing else is necessary but to find by experiment the percentage of oxygen, and the sulphur and nitrous compounds per cubic foot of the escaping gases, in order to arrive, by the simplest calculation, at the percentage loss of sulphur and nitre in the chamber exits.

Testing in this way will undoubtedly prove of great service to the acid maker; and if done continuously, it will serve two very important ends; the first, to serve as a check on the production of acid calculated from measurement; and the second, to act as a tell-tale against the chamber foreman, that he does not neglect the chambers and allow them to get out of order during the absence of the manager. More than this it cannot do; it cannot in any way assist the manager in controlling the working of the chambers by inspection in the usual way. Hence I cannot admit that my experience accords with Mr. Mactear's when he states at the end of his paper, that he found it "practically impossible to obtain steady results from sulphuric acid chambers worked on the ordinary system of inspection alone, &c.," unless by these expressions he only means to imply the too frequent carelessness and incompetence of chamber foremen and managers. It is certainly as easy to recognise by the eye, or even by the senses of smell or touch, an internal disorder in the chambers, as it is, a "green" batch of sulphate, a too "florid" ball, or a cone of "bilious" or "jaundiced" soda. Of course, with carelessness in the supervision the chambers will give bad results, just the same as any other department of the works. But with ordinary intelligence and care the trained foreman can readily detect, either by day or night, the first symptoms of the process getting wrong, and by immediately applying the remedy, effect a very speedy cure, before the disorder has had time to extend to the end of the series and result in an escape of sulphur; which, if it did occur, would be the first indication of the disorder that the test would give us, and that perhaps a whole day after its occurrence.

The determination of the oxygen is an important step, as you will observe, in this method of testing the escapes. A quick and handy, yet reliable method of determining oxygen in gaseous mixtures has long been a desideratum with the technical chemist. Various methods of absorption have been proposed from time to time, especially by German chemists; but all of them have proved either too tedious, or to require too complicated and fragile apparatus for the rough usage of a chemical works laboratory The phosphorus method is the one hitherto most commonly employed in chemical works; but it is both tedious and inaccurate, and the introduction of the phosphorus into the gas is rather an awkward operation. The method proposed by Vogt, using freshly precipitated protoxide of iron, also fails to give speedy results. Vogt himself declares that, with frequent shaking and using large excess of the protoxide, he could not complete the determination of the oxygen in the air in less than a day. Scheurer Kestner proposed another method, using nitric oxide (N_2O_2). But Max Liebig, who examined this method carefully, found that, though rapid enough, it was far from accurate. Scheurer-Kestner had assumed that when this gas is added to a gaseous mixture containing oxygen, only N_2O_4 is formed, and decomposed by the water into N_2O_3 and N_2O_5. But Max Liebig found that this was by no means the case; but that quantities of N_2O_3 were also formed, according to the relative proportions of the oxygen and nitric oxide presented to each other. Hence the decrease in volume, due to absorption, would in this case represent varying quantities of oxygen, according to the proportion of nitric oxide added. The last-mentioned chemist has also devised an apparatus for this purpose, employing the old absorbent, alkaline solution of pyrogallic acid. But it is much too complicated to be useful in a technical sense.

At last, however, we have got an apparatus which, I think, fully answers the requirements of the manufacturing chemist, as regards both simplicity and exactness, and which, I have no doubt, will soon find its place in every well appointed laboratory. I allude to the gas apparatus patented by M. Coquillon, a French chemist, and beautifully made by Alvergniat Frères, of Paris. It has been introduced this year on the Tyne, and was exhibited at the recent meeting of the Iron and Steel Institute in Newcastle. By the kindness of Messrs. Mawson and Swan, I am able to show it here to-night. In this form it strikes me as the real "multum in parvo" of a gas apparatus, being adapted for determining not only oxygen but also carbonic oxide, carbonic acid, hydrogen, and nitrogen in a gaseous mixture. If it is required for only one gas at a time, but one of the three absorbing tubes is needed. For oxygen the absorbing agent employed is either alkaline pyrogallate or ammonio-subchloride of copper. The latter, however, is much to be preferred of the two, as the copper sub-salt is being constantly renewed, and the solution thereby kept in the same state of efficiency by means of a close roll of fine copper gauze inserted in the absorbing tube. The latter dips with its open end downwards into a wider tube acting as a reservoir for the solu-

tion, and is connected by a strong yet fine capillary glass tube, leading out of its upper end, and provided with a well-ground glass tap, with the upper end of the measuring tube. The gas to be operated on, being measured in the latter over water at the atmospheric pressure, is then, by opening the connecting tap and raising the water bottle (connected by means of a long India-rubber tube with the low end of the measuring tube), driven over into the absorbing tube; the absorbing liquid at the same time rising into the outer reservoir, but leaving the meshes of the copper gauze wetted with a film of it. Here the absorption of the oxygen takes place very rapidly, in fact almost instantaneously, on account of the very large surface of absorbent thus exposed to the gas. By moving the water bottle slightly up and down for a few seconds, the gas is kept circulating among the meshes of the gauze, and total absorption hastened. Then by lowering the bottle the residual gas is again displaced from the absorbing tube by the rise of the copper solution. When this latter has reached exactly the same point of the capillary tube as it stood at before, the tap is closed, and the remaining gas measured once more under the same conditions: the difference of the two measurements gives the oxygen absorbed.

I have tested an apparatus of this sort (more roughly constructed but on the same principle) with determination of oxygen in the air, and found it to give surprisingly accurate results in a very short time. Five minutes I found amply sufficient for one determination, either in air or any other gaseous mixture. In the case of air a long string of determinations one after another, made as rapidly as possible and with no particular care, gave results all within one-half per cent of the truth, but more frequently giving either the exact figure, 20·8, or a tenth per cent less or more. These facts sufficiently vouch for the rapidity and accuracy of the method. Being so rapid there need not be any change of temperature superinduced in the gas between the two measurements. To prevent, however, the possibility of this taking place, so as to affect the accuracy of the results, the measuring tube might easily be jacketed with water, and a fine thermometer kept suspended in the latter.

When employing this apparatus to determine the percentage of oxygen in the chamber escapes, I found that, to adjust the apparatus, go and collect the sample of gas, transfer it to the measuring-tube, measure, absorb, and measure again, not more than a quarter of an hour to twenty minutes was needed. I also found that, at the Jarrow Works, the oxygen in the escapes of different sets, at different times, varied between 8½ and 11½ per cent, though 9 per cent was about the average when the draughts were not excessive.

By testing the chamber outlets continuously, in the way described, Mr. Mactear has found that, with steady working, the average loss of sulphur is about one-half per cent of the sulphur burnt; and I am informed by Mr. Stuart that that is also about the average of their loss at the Hebburn Works during many months continuous testing.

It is interesting to compare these very excellent results, which, I have no doubt, are quite equalled in many other acid plants, with the very deplorable state of matters disclosed by the table of figures, given by Dr. Angus Smith, in his Report for 1871. These figures show the quantities of the two sulphur acids per cubic foot of the waste gases which he found escaping from a large number of vitriol plants over the country. The number of escapes tested was fifty-three. The average of the total sulphur acids as SO_3 in grains per cubic foot of the waste gases was 8·3484, equal to 3·339 grs. sulphur. Calculating this into the percentage escape on sulphur burnt, according to the table I have given (allowing 10 per cent oxygen in waste gases), we have 3·339 grs. lost per 42·9 burnt, or about 7·7 per cent. More surprising even than this very high average is the immense difference shown between the best and the worst by his figures, the minimum being represented by 0·1648, and the maximum by 51·7931 grs. SO_3 per cubic foot, or, calculated in the same way as before, into per cents, 0·15 per cent and 47·65 per cent. Of the fifty-three eleven are under ½ per cent; six under 1 per eent; one over 5 per cent and under 10 per cent; two over 10 per cent and under 15 per cent; eight over 15 per cent and under 20 per cent; and seven over 20 per cent. If we are to credit these figures that in the year 1871 of fifty-three works examined fifteen were allowing more than 15 per cent of all the sulphur they burnt to escape up the chimney, what a revelation it would be of the utter and reckless mismanagement of many acid plants at that time. It is to be hoped that the Alkali Inspector cannot point to any tests at all like these now-a-days.

(To be continued.)

CORRESPONDENCE.

RELATION BETWEEN GASEOUS VOLUME AND VALENCY.

To the Editor of the Chemical News.

Sir,—I do not know if it has been pointed out that there may be a simple relation between the volumes of a gas and the valency of its atoms. We know if we take two atoms of hydrogen gas = 2 vols. at a certain pressure, we must double the pressure to reduce it to half its volume. Also if we combine one atom of oxygen = 1 vol. with two vols. of hydrogen, the three volumes are reduced to two. Now, if we suppose that one atom of oxygen is not only equivalent to two of hydrogen in the sense of combining with them, but also that it exerts twice the attractive energy on each atom, then the two atoms of hydrogen will be drawn together by a double force, and the two volumes will be reduced to one, which, with the one of oxygen, makes up the two volumes of H_2O gas we find by experiment.

In the same manner, nitrogen being equivalent to three atoms of hydrogen, will attract each atom with energy three times as great as hydrogen for hydrogen, and thus reduce the 3 vols. to one, and so on. In the case of such a compound as NO, where the valency of the one is 3, and the other 2, there will be no contraction, because, while the oxygen is attracted by greater energy than when only under its own attraction, and therefore will contract in volume, the nitrogen is attracted by less, and in the same proportion, and will, therefore, expand so that the volume will remain constant. The same relations can be traced in the combinations of compound gases, although not so apparent.

If these relations are real, they would throw some light on such phenomena as the regular increase of density, &c., of the paraffins, by each addition of CH_2, and taken in connection with some views of solution I ventured to put forth in Chemical News, vol. xxxvii., page 47, would aid in explaining what may be called inverted chemical affinity. In this connection allow me to mention that on closer examination into the action of HCl on crystals of $Na_2SO_4 + 10H_2O$, a considerable quantity of NaCl seems to be formed. I hope to continue this investigation shortly.

William Durham.

Edinburgh, April 30, 1878.

NITRIC ACID IN THE VITRIOL MANUFACTURE.

To the Editor of the Chemical News.

Sir,—I have read with much interest the papers of Mr. G. E. Davis on this subject in your recent issues, and in

the view that such investigations are for the elucidation of truth, and are looked on, when published in your journal, in the light of standard information (as witnessed by their constant republication in other countries), I think it right to call attention to the following points :—

(1.) The reduction of the nitrous compounds to nitrogen or nitrous oxide by hot sulphurous gases is too well established practically to be disposed of in the way Mr. Davies does in his paper, at page 155. In cases where the nitrate of soda is decomposed in pots placed actually in the burners (a very bad plan, but one still sometimes followed), there is most certainly a much larger amount used.

(2) That the nitrous compounds enter the chambers from the Glover towers as N_2O_2 is an assumption difficult to prove, and certainly the statement that "the arsenic which is present in the nitrosulphuric is at the same time reduced to arsenious acid, and as such leaves the concentrating or denitrating tower," is only partially true, arsenic and arsenious acids existing in all the Glover tower acids which I have had examined.

(3.) That the reaction in the Gay-Lussac tower is that of an oxidation of the As_2O_3 by the N_2O_3 present, N_2O_2 escaping in proportion. The amount of As_2O_3, then, which is put down the absorbing column, is the measure of the limit of nitre which can be used. Mr. Davis has by no means proved this assertion, and in the first place it is not the general condition of things that all the arsenic exists as arsenic acid in the nitrous vitriol, and in the second it is not yet proved that it is N_2O_3 which oxidises the As_2O_3, especially in the presence of higher oxides of nitrogen, which are *always* present in the gases escaping from the chambers to the towers, and of which Mr. Davis has shown considerable quantities in the Gay-Lussac acid.

(4.) The basing of such calculations on quantities of one cubic foot, taken three or four times per week, when the amount of gases escaping is measured (as in cases E, F, G) by from 20 to 48 millions of cubic feet per week, is evidently quite unsound, and would in itself render the results of such calculations more than doubtful. The speed of draughts and amounts of oxygen vary very largely, even from hour to hour.

James Mactear.

St. Rollox, Glasgow.
May 1, 1878.

NITRE LOSSES IN THE VITRIOL MANUFACTURE.

To the Editor of the Chemical News.

Sir,—Since the appearance of my paper in your issue of the 18th ult., I have received many letters from chemists upon this subject, which leads me to make the following remarks :—

Firstly, I consider to have proved that in the vitriol manufacture, working *without towers*, the whole of the nitre used can be accounted for, as in the instances A, B, C, and D given.

Working *with towers* I do not claim to have discovered where the real loss is. The reaction is not proven between arsenious acid and nitrous anhydride *by laboratory experiments*, and I argue that the loss takes place here, from the observation that the arsenic acid is produced in the tower from the arsenious acid which the vitriol contained, and from finding nitric oxide in the escaping gases. It has been pointed out to me that the arsenious acid was most probably oxidised by N_2O_4. It may be so; then another source of loss must be searched for; but I have pointed out that the loss of N_2O_3 is nearly equal to the amount which would be decomposed by the arsenic run down the absorbing tower—a strange coincidence—and I have also observed in one works that where the amount of arsenic in the vitriol was large, it was impossible to work with the minimum quantity of nitre used by other makers.—I am, &c.

George E. Davis.

Barton Arcade, Manchester.
May 4, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 13, April 1, 1878.

Specific Heats and the Melting Heat of Gallium—M. Berthelot.—M. Lecoq de Boisbaudran having placed at the author's disposal an ingot of gallium weighing 34 grms., he determined its specific heat, both in the solid and the liquid state, and also its melting heat, making use of his ordinary methods with the water calorimeter. Gallium melts at +30°; but it may be kept liquid in a state of superfusion down to near 0°. The specific heat in the liquid state was determined twice, one experiment between 119° and 13°, and the other between 106° and and 12·5°; the value found was 0·0802. The solid specific heat between 23° and 12° was found =0·079. This determination must not be made too near the point of fusion. The melting heat is determined by introducing some crystals into superfused gallium, when the metal crystallises rapidly. At 13° the author obtained the mean result +19·11 cals. This number remains sensibly unchanged at all temperatures between 30° and 0°. If referred to the atomic weight, 69·9, it becomes 1·33 cals. The atomic specific heat in the liquid state =5·59, and in the solid 5·52. This is the same as that of aluminium (5·53) and glucinium 5·64.

Action of Oxygen upon the Acid Chlorides, Bromides, and Iodides of Aluminium.—M. Berthelot.—The displacement of chlorine by oxygen with the formation of alumina should disengage a heat about +34·9. The displacement of gaseous iodine in the same manner liberates +109·5°; an enormous value which explains the ignition of aluminium iodide. The same holds good with the iodides of phosphorus, silicium, arsenic, antimony, and tin, which are all combustible. The displacement of gaseous bromine by dry oxygen liberates +62·2.

Physical Properties and Specific Heat of Glucinium.—L. F. Nilson and O. Pettersson.—Glucinium in its salts presents certain analogies both with the magnesium and with the aluminium group, but no decisive clue is afforded to the true atomicity of the metal, which can only be deduced from its specific heat. The preparation of the metal is difficult; the authors could not succeed in obtaining it from its chloride by the electric method, and they adopted, therefore, the process of Wöhler and Debray, decomposing the chloride with potassium or sodium in a wrought-iron crucible closed with a screw. Glucinium thus obtained is a steel- or tin-grey metal, of the sp. gr. 1·901 at 0°. It is hard and crystallises readily. If melted it breaks under the hammer, and does not fuse at a temperature where salt is readily volatilised. It is inalterable in the air, and even at a red heat in a current of oxygen. Vapour of sulphur does not affect it. Before the oxidising flame it becomes covered with a layer of oxide, but does not take fire. It has no action upon water either warm or cold. It decomposes hydrochloric and hydrosulphuric acid and the alkaline hydrates, hydrogen being evolved very briskly if heat is applied. Nitric acid attacks it more slowly. The sp. gr. of the impure metal being 1·9101, that of pure glucinium from its known composition was calculated at 1·64. The specific heat of glucina

between 0° and 100° is 0·2471. Hence it must be considered analogous to aluminium, its atomic weight being 13·8, and its oxide having the formula Be_2O_3.

A Peculiar Reaction of Certain Polyatomic Alcohols.—D. Klein.—In presence of mannite, boric acid forms energetic conjugated acids. In presence of an alkaline or alkaline-earthy biborate a very large excess of this polyatomic alcohol removes from the biborate a part of this acid in consequence of the tendency of this acid to form a conjugated acid with the base. Water dissociates these compounds.

A New Way of Separating Arsenic from other Metals.—MM. de Clermont and Frommel.—Supposing a mixture of arsenic, antimony, and tin, the whole is converted into sulphides by treatment with sulphuretted hydrogen, after having acidulated with hydrochloric acid, adding also tartaric acid if antimony is present. When the mixture is saturated it is allowed to stand in a warm place till the odour of sulphuretted hydrogen is no longer perceptible, and is then thrown upon a filter and washed with much care, as the least residue of hydrochloric acid would cause a loss of arsenic in the state of chloride. The whole is then transferred into a flask full of water, and heated to a boil. The reaction is more rapid in a retort through which a current of air is passed. If the quantity of arsenic does not exceed 2 decigrms. the distillation of 500 to 600 c.c. of water suffices for the complete dissociation of the sulphides. The residue is then filtered, and the entire quantity of the arsenious acid is found in the filtrate, and determined by the ordinary methods.

On Melilotal.—T. L. Phipson.—Melilotal has the composition $C_{18}H_8O_6$. It differs from coumarin by its composition, its acid reaction with litmus, its odour, and by the fact that its alcoholic solution does not crystallise.

Reimann's Färber Zeitung,
No. 12, 1878.

The students of the University of Berlin celebrated, on the 7th of last month, the sixtieth birthday of Prof. A. W. Hofmann.

The light of Swedish matches is found sufficiently white for comparing colours.

Lake colours are now prepared by dissolving artificial alizarin in a caustic alkali, adding an alkaline aluminate, and precipitating by the addition of a weak acid or an ammoniacal salt.

No. 13, 1878.

Fixation of Eosin upon Cotton.—E. Apelt.—The author shows that the best mordant for eosin upon cotton is acetate of alumina, the pieces or yarns being subsequently taken through a chalk-bath; the colour-bath should contain a little acetic acid. Precipitated silicic acid and other porous bodies are useless.

Rose Bengale.—This is a new dye of a beautiful blue-red colour, a substitution product of fluorescein. Cotton is prepared for its reception by treatment with an emulsive oil, as for Turkey-red dyeing, and subsequent steeping, when dry, in acetate of alumina, a little of which is also added to the colour-bath.

Chrome Residues.—Residues containing chromic oxide derived from the reduction of potassium chromate are of frequent occurrence, *e.g.*, in the manufacture of artificial alizarin. Wagner proposes to treat such with a mixture of soda-lye and potassium ferridcyanide, and thus effect the re-oxidation of the chrome. Or chromic oxide may be heated with soda-lye and bromine may be added in small successive portions till all chromic oxide has disappeared and the liquid becomes clear and yellow.

Caulin is the name given by a patentee to the colouring matter of red cabbage, which he proposes to extract with boiling-water, and to precipitate with certain metallic salts and oxides, using the lakes thus obtained in the arts.

No. 14, 1878.

Ozone is giving its name to various articles with which it has no connection, as, for instance, "ozonite copying ink."

Silicate of soda is recommended for preparing unbleached cottons for the indigo vat.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 13, March 28, 1878.

According to the *Journal d'Oculistique* an obstinate case of neurosis of the eyes has been cured by the use of *yellow* spectacles.

No. 14, April 4, 1878.

This issue contains no original chemical matter.

No. 15, April 11, 1878.

Strange Effects of Lightning.—At Vernon about six years ago lightning fell in a plot of ground planted with gooseberry and cherry trees, making a deep hole in the ground not more than 10 centimetres in diameter. Subsequently the trees have died away in a circle, which extends wider and is now 7 metres in diameter. The question arises why the morbid action is permanent and why the sterility spreads?

A plant named Hoang-man is attracting much attention as a remedy for leprosy.

MEETINGS FOR THE WEEK.

Monday, May 13th.—Royal Geographical, 8.30.
Tuesday 14th.—Civil Engineers, 8.
— Anthropological Institute, 8.
— Royal Institution, 3. "On Some Points in Vegetable Morphology," W. T. Thiselton Dyer, M.A.
Wednesday, 15th.—Society of Arts, 8.
— Pharmaceutical, 8. (Anniversary).
— Meteorological, 8. "Daily Inequality of the Barometer," W. Rundell, F.M.S. "Meteorology of Mozufferpore, Tirhoot, for 1877," C. N. Pearson, F.M.S. "Note on the Great Rainfall of April 10th-11th, as recorded at the Royal Observatory, Greenwich," W. Ellis, F.R.A.S. "Observations of Sea Temperature at Slight Depths," Capt. W. F. Caborne, F.M.S.
Thursday, 16th.—Royal 8.30.
— Royal Institution, 3. "On Colour," Lord Rayleigh, M.A.
— Royal Society Club, 6.30.
— Chemical, 8. "The Action of Hypochlorites on Urea," H. J. H. Fenton. "On the Behaviour of Metallic Solutions with Filter Paper; and on the Detection of Cadmium," Thomas Bayley. "On the Action of Bromine on Sulphur," J. B. Hannay. "On the Determination of High Boiling-points," T. Carnelly, D.Sc., and W. C. Williams. "On Essential Oil of Sage," M. M. P. Muir and S. Suguira. "On High Melting-points," T. Carnelly, D.Sc.
Friday 17th.—Royal Institution, 8, Weekly Meeting. "On Speech," Prof. Graham Bell, 9.
Saturday, 18th.—Royal Institution, 3. "On Richard Steele," Prof. Henry Morley.

Lately published, in one vol. of 1091 pages, with Diagrams and other Illustrations. 8vo. £1 11s. 6d.

EXPERIMENTAL RESEARCHES IN PURE, APPLIED, AND PHYSICAL CHEMISTRY.

By E. Frankland, Ph.D. (Marburg), D.C.L., F.R.S., Professor of Chemistry in the Royal School of Mines, &c.

The work includes investigations on the Manufacture and Illuminating Power of Gas, on the Water Supply of Towns, and the Purification of Drainage from Towns and Manufactories.

Also by Professor Frankland,

LECTURE NOTES FOR CHEMICAL STUDENTS. Second Edition. Vol. I. (Inorganic), 4s. Vol. II. (Organic), 5s.

London: J. VAN VOORST 1, Paternoster Row.

THE CHEMICAL NEWS.

Vol. XXXVII. No. 964.

ON THE ACTION OF SONOROUS VIBRATIONS IN VARYING THE FORCE OF AN ELECTRIC CURRENT.*

By Professor HUGHES.

The introduction of the telephone has tended to develop our knowledge of acoustics with great rapidity. It offers to us an instrument of great delicacy for further research into the mysteries of acoustic phenomena. It detects the presence of currents of electricity that have hitherto only been suspected, and it shows variations in the strengths of currents which no other instrument has ever indicated.

It has led me to investigate the effect of sonorous vibrations upon the electrical behaviour of matter. Willoughby Smith has shown that the resistance of selenium is affected by light, and Börnstein has led us to believe that many other bodies are similarly affected. We know also that the resistance of all bodies is materially influenced by heat. Sir William Thomson and others have shown that the resistance to the passage of currents offered by wires is affected by their being placed under strains, and, inasmuch as the conveyance of sonorous vibrations induces rapid variations in the strains at different points of a wire, I believed that the wire would vary in its resistance when it was used to convey sound. To investigate this I made a rough-and-ready telephone, with a small bar-magnet 4 inches long, half the coil of an ordinary electro-magnet, and a square piece of ferrotype iron 3 inches square, clamped rigidly in front of one pole of the magnet between two pieces of board. When using the pendulum beats of a small French clock, or the voice, as a source of sound, I found this arrangement supplied me with an extremely delicate *phonoscope* or sound detector.

All the experiments detailed in this paper were made with the simplest possible means, and no apparatus of any kind constructed by a scientific instrument maker was employed. The battery was a simple Daniell's cell, of Minotto's form, made by using three common tumblers, a spiral piece of copper-wire being placed at the bottom of each glass and covered with sulphate of copper, and the glass being then filled with well moistened clay and water. A piece of zinc as the positive element was placed upon the clay. Insulated wires were attached to each plate, and three of these cells were joined in series. All experiments were made on a closed circuit, the telephone being used as a phonoscope to detect variations in the current and the consequent reproduction of sound. The apparatus, or materials experimented upon, were used in the same way as the transmitter of the speaking telephone of Bell.

I introduced into the circuit a strained conductor—a stretched wire—listening attentively with the telephone to detect any change that might occur when the wire was spoken to or set into transverse vibrations by being plucked aside. Gradually, till the wire broke, the strain was varied, but no effect whatever was remarked except at the moment when the wire broke. The effect was but momentary, but invariably at the moment of breaking a peculiar "rush" or sound was heard. I then sought to imitate the condition of the wire at the moment of rupture by replacing the broken ends and pressing them together with a constant and varying force by the application of weights. It was found that if the broken ends rested upon one another with a slight pressure of not more than one ounce to the square inch on the joints, sounds were distinctly reproduced, although the effects were very imperfect.

It was soon found that it was not at all necessary to join two wires endwise together to reproduce sound, but that any portion of an electric conductor would do so even when fastened to a board or to a table, and no matter how complicated the structure upon this board, or the materials used as a conductor, provided one or two portions of the electrical conductor were separated, and only brought into contact by a slight but constant pressure. Thus, if the ends of the wire terminate in two common nails laid side by side, and are separated from each other by a slight space, were electrically connected by laying a similar nail between them, sound could be reproduced. The effect was improved by building up the nails log-hut fashion, into a square configuration, using ten or twenty nails. A piece of steel watch-chain acted well. Up to this point the sound or grosser vibrations were alone produced, the finer inflections were missing, or, in other words, the *timbre* of the voice was wanting, but in the following experiments the *timbre* became more and more perfect until it reached a perfection leaving nothing to be desired. I found that a metallic powder such as the white powder—a mixture of zinc and tin—sold in commerce as "white bronze," and fine metallic filings, introduced at the point of contact, greatly added to the perfection of the result.

At this point articulate speech became clearly and distinctly reproduced, together with its *timbre*, and I found that all that now remained was to discover the best material and form to give to this arrangement its maximum effect. Although I tried all forms of pressure and modes of contact, a lever, a spring, pressure in a glass tube sealed up while under the influence of strain, so as to maintain the pressure constant, all gave similar and invariable results, but the results varied with the materials used. All metals, however, could be made to produce identical results provided the division of the metal was small enough, and that the material used does not oxidise by contact with the air filtering through the mass. Thus platinum and mercury are very excellent and unvarying in their results, whilst lead soon becomes of such high resistance through oxidisation upon the surface as to be of little or no use. A mass of bright round shot is peculiarly sensitive to sound whilst clean, but as the shot soon become coated with oxide this sensitiveness ceases. Carbon, again, from its surface being entirely free from oxidation, is excellent, but the best results I have been able to obtain at present have been from mercury in a finely divided state. I took a comparatively porous non-conductor, such as the willow charcoal used by artists for sketching, heating it gradually to a white heat and then suddenly plunging it in mercury. The vacua in the pores, caused by the sudden cooling, became filled with innumerable minute globules of mercury, thus, as it were, holding the mercury in a fine state of division. I have also tried carbon treated in a similar manner with and without platinum deposited upon it from the chloride of platinum. I have also found similar effects from the willow charcoal heated in an iron vessel to a white heat, and containing a free portion of tin, zinc, or other easily vapourised metal. Under such conditions the willow carbon will be found to be metallised, having the metal distributed throughout its pores in a fine state of division. Iron also seems to enter the pores if heated to a white heat without being chemically combined with the carbon as a graphite, and, indeed, some of the best results have been obtained from willow charcoal containing iron in a fine state of division.

Pine charcoal treated in this manner (although a non-conductor as a simple charcoal) has high conductive powers, due to the iron; and from the minute division of the iron in the pores, is a most excellent material for the purpose.

Any one of these preparations confined in a glass tube or a box, and provided with wires for insertion in a circuit, I call a "transmitter."

Reis, in 1860, showed how, by the movement of a dia-

* A Paper read before the Royal Society, May 9, 1878.

phragm, intermittent voltaic currents could be transmitted, agreeing in exact number with the sonorous waves impinging on the diaphragm, and thus reproducing music at a distance by causing an electro-magnet to vibrate in unison with the diaphragm; and, with an iron diaphragm, Graham Bell showed how the vibrations of that diaphragm in front of a polarised electro-magnet could similarly induce magneto-currents, corresponding in number, amplitude, and form, with the sonorous vibration, and thus reproduce all the delicacies of the human voice. Edison and others have produced variations in the strengths of a constant current by causing the diaphragm to press directly upon some elastic conductor, such as carbon, spongy platinum, &c., the varying pressure upon these materials varying the resistance of the circuit, and consequently the strength of current flowing. Graham Bell and others have produced the same effect, by causing the vibrations of the diaphragm to vary the electromotive force in the circuit. It will be seen, however, that in the experiments made by myself, the diaphragm has been altogether discarded, resting as it does upon the changes produced by molecular action, and that the variations in the strengths of the currents flowing are produced simply and solely by the direct effect of the sonorous vibrations.

I have found that any sound, however feeble, produces vibrations which can be taken up by the matter interposed in the electrical circuit. Sounds absolutely inaudible to the human ear affect the resistance of the conductors described above. In practice, the effect is so sensitive, that a slight touch on the board, by the finger nail, on which the transmitter is placed, or a mere touch with the soft part of a feather, would be distinctly heard at the receiving station. The movement of the softest camel hair-brush on any part of the board is distinctly audible. If held in the hand several feet from a piano the whole chords—the highest as well as the lowest—can be distinctly heard at a distance. If one person sings a song, the distant station, provided with a similar transmitter, can sing and speak at the same time, and the sounds will be received loud enough for the person singing to follow the second speech or song sent from the distant end.

Acting on these facts, I have also devised an instrument suitable for magnifying weak sounds, which I call a *microphone*. The microphone, in its present form, consists simply of a lozenge-shaped piece of gas carbon, one inch long, quarter inch wide at its centre, and one-eighth of an inch in thickness. The lower pointed end rests as a pivot upon a small block of similar carbon; the upper end being made round plays free in a hole in a small carbon-block, similar to that at the lower end. The lozenge stands vertically upon its lower support. The whole of the gas carbon is tempered in mercury, in the way previously described, though this is not absolutely necessary. The form of the lozenge-shaped carbon is not of importance, provided the weight of this upright contact piece is only just sufficient to make a feeble contact by its own weight. Carbon is used in preference to any other material, as its surface does not oxidise. A platinum surface in a finely divided state is equal, if not superior, to the mercurised carbon, but more difficult and costly to construct. I have also made very sensitive ones entirely of iron.

The best form and materials for this instrument, however, have not yet been fully experimented on. Still, in its present shape, it is capable of detecting very faint sounds made in its presence. If a pin, for instance, be laid upon or taken off a table, a distinct sound is emitted, or, if a fly be confined under a table-glass, we can hear the fly walking, with a peculiar tramp of its own. The beating of a pulse, the tick of a watch, the tramp of a fly, can thus be heard at least a hundred miles distant from the source of sound. In fact, when further developed by study we may fairly look for it to do for us, with regard to faint sounds, what the microscope does with matter too small for human vision.

It is quite evident that these effects are due to a difference of pressure at the different points of contact, and that they are dependent for the perfection of action upon the number of these points of contact. Moreover, they are not dependent upon any apparent difference in the bodies in contact, but the same body in a state of minute subdivision is equally effective. Electrical resistance is a function of the mass of the conductor, but sonorous conduction is a function of the molecules of matter. How is it, therefore, that a sonorous wave can so affect the mass of a conductor as to influence its electrical resistance? If we assume a line of molecules, we know that a sonorous wave is accompanied by alternate compressions and rarefactions. If we isolate the part under compression from the part under dilation we vary the dimensions of the mass, and we alter its electrical resistance. In any homogeneous conductor of finite dimensions the effect of the one will exactly compensate for the effect of the other, and we get no variation of current, but if we break up this homogeneous conductor into a series of minute subdivisions without actually breaking their electrical continuity, we destroy its neutralising influence, and we render evident the effect of sonorous vibrations in varying the dimensions of the mass of the conductor, and therefore in varying its electrical resistance, for we reduce the length of a portion of the conductor to a fraction of the length of a sonorous wave. Molecular action alone explains to me all the effects produced. Size or shape does not affect them. A piece of willow charcoal the size of a pin's head is quite sufficient to reproduce articulate speech. I regard the action as follows:—If we have two separate conductors joined simply by contact, this contact offers a certain resistance. Now we can vary or lessen the resistance by increasing the pressure, thus bringing more points in contact or closer proximity. Now, as I employ a constant pressure on the contact, which is exactly under the same influence of the vibrations as the points of contact, more points or closer proximity can only be obtained through the molecular swelling or movement of the contact points.

The tube transmitter, which I exhibit this evening, consists of an exterior glass tube two inches long and one quarter of an inch in diameter. In it are four separate pieces of willow charcoal, each one quarter of an inch long, and two terminals of the same material. The terminals are fastened in the tube, and connect exteriorly with the line and interiorly with the four loose pieces.

The instant the sonorous vibrations pass in the tube there is electric contact to a remarkable degree, which could only have taken place by the molecules enlarging their sphere under the influence of the sonorous vibrations.

It is impossible to say what can be the applications or the effects of the discovery which I have had the honour of bringing before the Royal Society, for the whole question has been studied with crude materials, and scarcely sufficient time has elapsed to enable me to consider its ultimate uses. I do not desire to assert that there is anything in what I have brought forward that is superior to or equal to other transmitters used for telephony. It is as loud and far more sensitive than any I have yet heard, and it may be increased by multiplication of transmitting contacts in quantity or intensity; the loudness is at present limited by the capability of the receiver. The materials at my disposal, and the arrangement of them, have not yet been sufficiently studied. I only wished to show that it is possible to transmit clear and intelligent articulate speech, and to render audible sounds which have hitherto been inaudible by the mere operation of sonorous vibrations upon the conducting power of matter.

My warmest thanks are due to Mr. W. H. Preece, electrician to the Post Office, for his appreciation of the importance of the facts I have stated, and for his kind counsel and aid in the preparation of this paper.

I do not intend to take out a patent, as the facts I have mentioned belong more to the domain of discovery than invention. No doubt inventors will ere long improve on

the form and materials employed. I have already my reward in being allowed to submit my researches to the Royal Society.

NOTES OF WORK DONE IN MESSRS. POKORNY, FIELDER, AND CO.'S LABORATORY.

By E. SONSTADT, F.I.C., F.C.S.

I. On Acetic Acid.

During last summer I made a series of experiments on the freezing-point of acetic acid, pure or glacial, and diluted with successive portions of water, and found that the temperature at which freezing began furnished a very ready and accurate means of determining the percentage of dilution. I was only recently aware that this work had been done (and, I may add, very efficiently done) before me by Rüdorff, an abstract of whose paper on the subject is given in the second supplement to "Watts's Dictionary." I made, however, some observations, not included in Rüdorff's paper, which I trust may be thought of sufficient interest to deserve publication.

Rüdorff's statement that glacial acetic acid may with care be cooled down to 8° without freezing is perfectly accurate. In a sealed bottle I have known the glacial acid to remain throughout a winter, in a room without a fire, in the liquid state; nor did the most violent shaking at about 8° alter its condition. Nevertheless, I found that crystallisation could be immediately induced by placing the vessel containing the acid in contact with a freezing-mixture. Crystals would shoot out almost instantly if the glass was thin, from the chilled part. Another way of inducing crystallisation—quite as effective as the introduction of a crystal—is to introduce a wire, preferably a stout platinum wire, and either let it drop suddenly and sharply to the bottom of the vessel, or rub the end of the wire briskly against the side. If the acid is capable of crystallising at the temperature crystals will immediately shoot out from the points of contact. The wire may be plunged red-hot into the acid and the same result obtained, provided the bulk of fluid is sufficient to prevent the heating from the wire raising the temperature too high for crystallisation to occur: proving that the crystallisation thus induced is independent of nuclei coming from without. Two wires rubbed one against the other in the liquid usually give the same result, though with less certainty, probably because the metal used (platinum) is so much softer than glass. A glass rod may be used in the same way as a wire; but, if the acid is very near the temperature of crystallisation, the rod must be made to rub the side of the vessel with considerable force.

As a definite hydrate of crystallised acetic acid is supposed to be formed when the aqueous solution attains its maximum density, it might be anticipated that the acid of such density would, when cooled down sufficiently, give crystals of such definite hydrate. I found, however, that the acid containing 79 per cent $C_2H_4O_2$, when crystallised even at so low a temperature as 0°, does not give a hydrate, but simply the pure acid. This fact has a practical value, since it shows how readily during winter time a dilute acid may be made to yield a strong acid by simply crystallising and draining off the mother-liquid. It was by many repetitions of this process that I obtained from the ordinary commercial glacial acid the pure acid necessary for my experiments. The pure acid once obtained can only by great care be preserved dry, for it is, I think, as hygroscopic as pure alcohol.

When once it was proved that only the pure acid crystallised out at any temperature down to 0° from a solution of whatever strength that was at all crystallisable it seemed probable that the solid acid would form a freezing-mixture with water or ice, and it proved to be so. In one of the experiments, some crystals having been obtained from a dilute acid by a freezing-mixture (it being summer time, and the temperature of the room above 20°), the mother-liquid was poured off the crystals, and, when these were at a temperature of 4°, some moist fragments of ice were added. The mass became nearly all liquid, and the thermometer sank to −12°, or a depression equal to 16° C. In another experiment 52·24 grms. of the glacial acid were added to 15·92 grms. water, and the solution cooled to −15°. Crystallisation then set in, and the thermometer rose to 0°, the liquid being almost completely full of crystals, although containing much mother-liquid. The flask was cooled to −3°, and ½ c.c. water added. The crystals began sensibly to dissolve, and the thermometer to fall. At −12° another ½ c.c. water was added, and, the flask being in a freezing-mixture at about −12°, a slight further depression of temperature took place, accompanied by further liquefaction of the crystals. The third dose of water again caused depression of temperature, with further solution of crystals, though, meanwhile, the bath of freezing-mixture was in the warm room rising in temperature. Lastly, 1 c.c. of water at about 20° was added, on which the thermometer rose momentarily one degree, sinking immediately afterwards to −15·5°, or a little below the temperature of the bath. The liquid was now very nearly free from crystals. The quantity of water now present in the solution was nearly 18½ grms., and as the quantity of glacial acetic acid taken was nearly 52¼ grms., the solution contained about 74 per cent crystallisable acid. Thus it appears that an acid of this strength remains practically liquid at −15° C. Probably at some lower temperature a hydrate would crystallise out.

Rüdorff gives 16·7° as the freezing-point of pure acetic acid. My standard acid crystallised at about 17·5°, but to obtain so high a point I found very difficult, for the last traces of water are obstinately retained. Unless this difference is due to our thermometers not being exactly comparable, Rüdorff's 100 per cent acid would have contained between a third and a half per cent of water. As in the abstract of this chemist's paper already referred to no mention is made of the purity of the standard acid used being ascertained by independent methods, and as I have done so with my acid, I incline to the opinion that Rüdorff's acid was probably not perfectly free from water, though in the absence of the necessary data some doubt on this point must remain.

ON THE SPECIFIC GRAVITY OF SOME SPECIMENS OF BESSEMER STEEL.

By SERGIUS KERN, M.E., St. Petersburg.

In the Chemical News (vol. xxxvii., p. 48) the author described some experiments made with the Bessemer metal, samples of which were obtained from the retort just before the addition of the spiegeleisen.

As it was of some interest to know the specific gravity of such a metal in the forged state, a specimen was hammered under a steam-hammer, and from the bar four pieces were cut and polished in order to examine the specific gravity, which was found to be at 16° C.:—

Samples.		Sp. Gr.
Outside part	I.	7·4821
	II.	7·4902
Inside part	III.	7·5009
	IV.	7·4938

The fact that such a specimen of Bessemer steel has such a low specific gravity, even in a hammered state, may be explained by the porosity and great difficulty in forging such a metal, which in the melted state was not freed from the oxides of iron by the addition of a convenient quantity of spiegeleisen.

Obouchoff Steel Works.

ON THE

CHEMICAL AND MECHANICAL ANALYSES OF CAST-STEELS.

By SERGIUS KERN, M.E., St. Petersburg.

This present paper refers to certain experiments of the author during the last summer, which collected together may be of some interest. In metallurgy there is an open question of great importance—that is, to what extent chemical analyses of cast-steel show the quality of the metal. Most of the steel works having laboratories classify their raw products by analysing them for chemically combined carbon by Eggertz's colorimetric method. This being executed, the raw products are sent to the rolling-mills and machine-shops, and it is only when the desired products are executed that small test-bars are taken from them in order to be mechanically tested. If the material shows inferior qualities it is then analysed in full. But in this case the analysis seldom helps, because good and bad steel often show no difference whatever in chemical composition. This fact is known to many, and this may be easily shown by the following tables. All these steels were used for the manufacture of tyres, axles, and steel-plates for bridges, &c.:—

Table A.

(*Steel of Good Quality.*)

Samples. Nos.	Combined Carbon.	Graphite.	Si.	Mn.	S and Ph.	Cu.
1.	0·29	0·01	0·07	0·13	traces	none
2.	0·60	0·03	0·12	0·07	—	—
3.	0·67	0·02	0·16	0·18	none	0·02
4.	0·59	0·02	0·16	0·13	—	none
5.	0·60	0·04	0·16	0·16	—	—
6.	0·47	0·03	0·15	0·24	—	—
7.	0·39	0·05	0·16	0·17	—	0·01
8.	0·50	0·04	0·10	0·18	—	0·03
9.	0·60	0·08	0·15	0·16	—	traces
10.	0·25	0·01	0·03	0·08	—	none

Table B.

(*Steel of Inferior Quality.*

Samples. Nos.	Combined Carbon.	Graphite.	Si.	Mn.	S and Ph.	Cu.
1.	0·28	0·03	0·09	0·19	traces	0·01
2.	0·48	0·02	0·16	0·10	none	none
3.	0·44	0·02	0·10	0·12	—	—
4.	0·68	0·02	0·19	0·10	—	0·03
5.	0·44	0·02	0·17	0·12	—	none
6.	0·58	traces	0·20	0·19	—	—
7.	0·38	0·05	0·18	0·13	—	—
8.	0·56	0·01	0·16	0·07	—	—
9.	0·45	0·01	0·15	0·09	traces	—
10.	0·56	0·02	0·14	0·12	—	0·01

In other cases, however, the chemical analyses show very accurately and visibly the difference between good and bad materials:—

	Bad Steel.			Good Steel.		
	I.	II.	III.	I.	II.	III.
Combined carbon and graphite ..	0·53	0·70	0·40	0·49	0·72	0·35
Silicon	0·64	0·61	0·59	0·01	0·06	0·05
Phosphorus	0·03	0·01	0·01	0·03	none	
Sulphur	0·06	none	0·01	0·03	0·01	none
Manganese	0·55	none		0·57	none	
Copper	0·03	none		0·02	none	0·01

In this case the inferior quality of bad steel may be directly attributed to the great quantity of silicon in the presence of an excess of carbon, as it is known that steel may contain 1 to 1·5 per cent of silicon, provided that the quantity of carbon in the steel would be as low as possible. We know that steel containing copper to a certain extent is red-short: metallurgists tell us that 0·3 to 0·4 per cent of copper renders the steel red-short, a quality very noxious in artillery pieces. But several analyses of Krupp's heavy guns show that from steel containing copper capital artillery pieces were manufactured. The following is a table showing the composition of these guns:—

Eight-inch Guns.

	I.	II.	III.	IV.	V.
Combined carbon	0·56	0·64	0·42	0·50	0·69
Graphite	0·04	0·04	0·04	0·02	0·02
Silicon	0·19	0·10	0·11	0·09	0·06
Manganese ..	0·18	0·16	0·13	0·07	0·15
Phosphorus ..	traces		none		traces
Sulphur	—	—	—	—	—
Copper	0·27	0·35	0·30	0·35	0·26

These tables of the chemical analyses of steels show that the steel after casting must be first mechanically tested in the smith's shop, as a clever smith in some minutes will tell for what purpose the steel in hand may be used. If a smith is not believed, Kirkaldy's testing-machine may be used for this purpose.

This opinion does not mean that the chemical analysis of the steel may be neglected; nay, it would be even desirable to analyse every casting, not only for combined carbon, but also for silicon, the quantity of which present often shows the quality of the steel: but in all cases the mechanical test must precede the chemical analysis.

Some years ago, when Eggertz's process was unknown, steel products were ordinarily classified by means of the mechanical test, and seldom faults occurred. Now when the carbon plays a great part in the classification of the raw material, it often happens that steel containing 0·70 per cent of carbon under the steam-hammer behaves as soft steel, and steel with 0·35 to 0·40 per cent of carbon is very hard and hammers very badly. It is, indeed, difficult to know the mean percentage of carbon in the received ingot, when from an ingot weighing often several tons, in most of the works a small sample is taken, from which, for the estimation of the percentage of carbon in the ingot, 0·1 grm. is used.

In conclusion, I will make some remarks on the uniformity of the percentage of carbon in crucible-steel. The just-mentioned misapprehension in the analyses of ingots always happens when puddled-steel is used in preparing cast-steel, because a bar of puddled-steel often shows a great difference in the percentage of carbon in its various parts. In order to avoid this inconvenience, there is only one way—the use of the Bessemer or Siemens-Martin steels. In this way the metallurgist may always closely know how to mix his raw materials in order to receive cast-steel with a certain percentage of carbon.

CONTRIBUTIONS TO BLOWPIPE CHEMISTRY.

First Paper.—New Blowpipe Bellows.*

By P. CASAMAJOR.

This apparatus works by water pressure. It is formed of two drums, A and B (see fig. 1), connected by a pipe C, open at both ends, which I will call the *water-pipe*. Another pipe D, which I will call the *outlet air-pipe*, is connected with both drums, and serves to carry off the compressed air from the lower drum to the nozzle of the blowpipe. In addition to these, the drum A is provided with a tube E, and the drum B with a tube F, which I will call the *inlet air-pipes*. The function of these is to admit air into the upper drum.

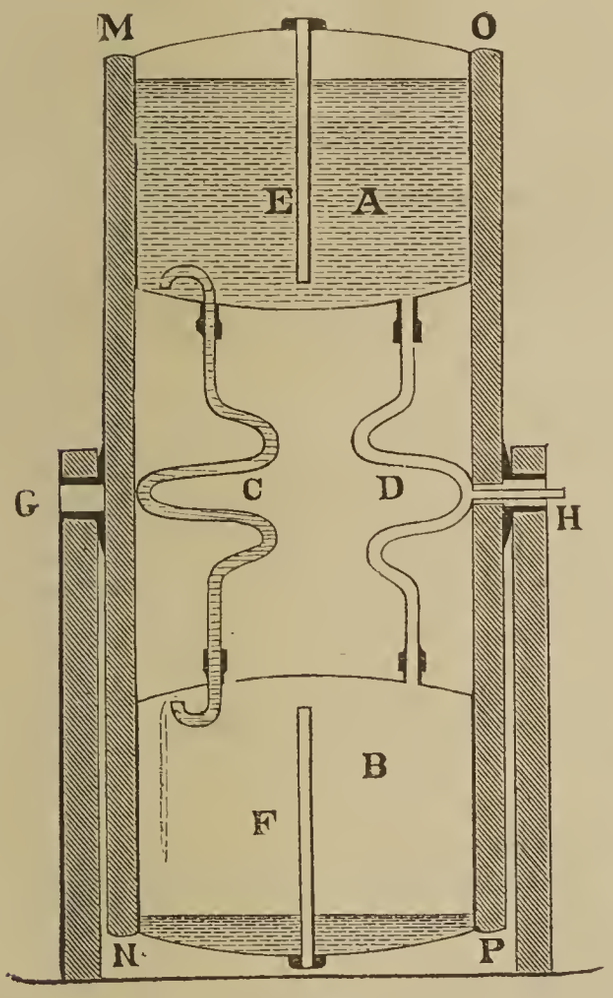
The upper and lower drums are firmly fixed on two upright pieces of wood, M N and O P, which are provided with journals, G and H, which turn in bearings attached to a frame. One of the journals, H, is hollow, and through

* Read before the American Chemical Society, Feb. 7, 1878.

it passes a tube, soldered to pipe D, which serves to carry the air of the lower drum to the blowpipe.

If we suppose that the upper portion of the pipe D and that the pipe F are closed, while the lower part of the pipe D and the pipe E are open, and if, moreover, we suppose that the upper drum A is full of water, while the lower drum B is full of air, we may see that the water in A will run down the water-pipe, C, and fall into the lower drum. This produces pressure in this drum, which drives the air in it to the blowpipe, through the lower part of the pipe D. As the water descends to the lower drum, air is admitted to the upper one through the inlet air-pipe, E, so that finally the lower drum becomes full of water and the upper one full of air. We may then turn the drums on their journals G H, so as to place the drum B above the drum A. If now we close the inlet air-pipe of the lower drum and the upper portion of the pipe D, while we open the

Fig. 1.



inlet air-pipe F of drum B and the lower part of the outlet air-pipe D, the water of B, as it descends into A, will drive out the air of this drum to the blowpipe, through the tube D. When this action is over, the apparatus may again be reversed with the same result as before, and so on indefinitely.

It may be noticed, in figure 1, that the tubes C and D are curved instead of being straight. The object of these curves is to prevent the expansions and contractions of these tubes from injuring the drums, as these are held apart by the pieces of wood M N and O P, whose longitudinal expansions and contractions are insignificant when compared to those of the tubes, which are of metal. It may also be noticed that the water-pipe C terminates at each end by a curved portion, the object of which is to keep the lower part of this pipe full of water, when the water runs down to prevent the air of the lower drum from ascending through this pipe into the upper drum.

I have mentioned that it is essential for the proper working of this apparatus, that the upper inlet air-pipe and the lower portion of the outlet air-pipe D should be left open, while the lower inlet air-pipe and the upper part of the outlet air-pipe D should be tightly closed. It would be possible to accomplish these alternate openings and closings of air-pipes by providing each inlet air-pipe with a cock, and the outlet air-pipe D with two cocks, each placed between one of the drums and the middle of the pipe D. By alternately opening and closing these cocks with the hand, the desired object would be accomplished, but it has been found more convenient to use valves, which open and close automatically. As these valves must close very tightly, and with considerable pressure, I use the arrangement shown in figure 2, which works with entire satisfaction.

In figure 1, it may be noticed that the pipes C, D, E, F are enlarged at the portions at which they are inserted

Fig. 2.

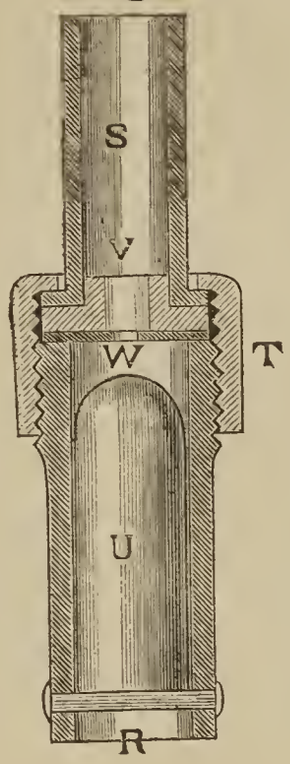
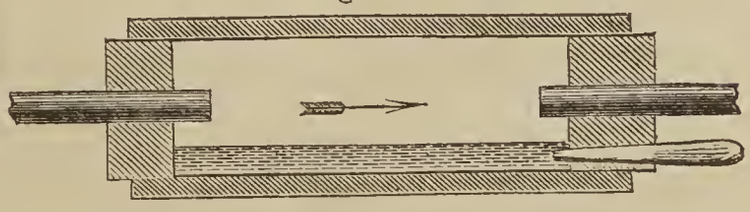


Fig 3.



in the drums. These enlargements correspond to screw couplings, which, in the case of the water-pipe C and the outlet air-pipe D, consist of two tubes, R and S, of which R is provided with a screw. A nut, T, works in the screw of the tube R, and this nut is provided with a shoulder, which presses down on the rim of the tube S, so that by turning this nut, the tubes R and S are brought tightly together. Between these two tubes, in the case of the water-pipe C, there is a washer of rubber or leather to keep the joint from leaking. In the case of the outlet air-pipe D the arrangement adopted is shown in figure 2. Between the tubes R and S, there is a cork washer, V,* cut, as shown in the figure, so that part of it enters in the tube S, while another portion is pressed between the tube R and the rim of the tube S. To the face of this cork

* Since this paper was written, I have found that cork and india-rubber are not sufficiently durable. The piece V should be made of hard wood or metal, and the washer W of leather. V should be perforated to allow W to be stitched on it, and there should be another leather washer between V and the pipe S.

washer, which is turned towards R, is stitched a soft rubber washer, W, about $\frac{1}{16}$ of an inch thick, its diameter being the same as that of the wide part of V. This rubber washer has a hole in its centre about $\frac{3}{16}$ of an inch diameter, while the cork washer has a hole of $\frac{3}{8}$ of an inch diameter.

At the end of the tube R furthest from the screw, a wire is placed in the diameter of the tube and riveted in its place. This wire is to prevent the weight U from falling further down, when placed as shown in the figure 2. This weight is cylindrical, with a hemispherical head at the end, which is turned towards the washer W. The diameter of the weight is slightly smaller than that of the interior of the tube R, that it may move in this tube with ease. The rounded end of this weight is polished, but the cylindrical portion may remain quite rough. The cylindrical portion has two deep grooves, to let the air pass freely from below the weight to the space above it. The function of this cylindrical weight is to close the opening left in the thin rubber washer W. This is easily understood by reversing figure 2, so that the tube R shall be above the tube S, in which case the weight U slips down and closes the opening in the thin rubber washer. The cylindrical weight U is made of an alloy of lead and antimony, which gives sufficient density, combined with hardness. The length of each cylindrical weight is $1\frac{3}{4}$ inches, the diameter being $\frac{1}{2}$ inch. Each one weighs 3 ounces.

An indispensable condition for the proper working of this valve is that the opening in the rubber washer W shall be in the axis of the tube R, as otherwise the weight U will not close this opening perfectly. It is to insure this condition, that a portion of the cork washer V has been given a smaller diameter; that it may be inserted in the tube S, and be kept from moving sideways. By attaching the thin rubber washer to this cork washer by a few stitches of thread, the rubber washer is kept immovable in its proper place.

The arrangement shown in figure 2 is, as I have said, the one adopted at each end of the outlet air-pipe D, the tube R being soldered on the drum. In the case of the inlet air-pipes, E and F, the tube S has been suppressed, and the cork washer is of sufficient diameter to fit in the nut T. The rubber washer is stitched on its under side, as before.

Constant Pressure.—By referring to figure 1, we may notice that the inlet air-pipes E and F are prolonged to nearly the bottom of their respective drums. The object of lengthening these pipes is to insure constant pressure to the blast.

In the positions of things shown in figure 1, the pipe F is closed, but the pipe E is open, and it may be seen that the drum A is equivalent to a *Mariotte's flask*, and the water pressure is represented by the distance from the lowest part of E to the outlet of the water-pipe. In the apparatus which I now exhibit before the society, this height is equal to 15 inches, equivalent to nearly 10 ounces pressure per square inch. Each drum in this apparatus has a diameter of 10 inches and a height of 8 inches.

The duration of the blast depends on the bore of the nozzle. For the small bore used in qualitative blowpipe tests, the drums have to be reversed every 35 minutes. For the bore used in Plattner's quantitative assays, the duration is 20 minutes. For a large flame, fit for glass blowing, using a bore equal to No. 22 wire gauge, the duration is 12 minutes.

Spring-catch.—A necessary feature of this apparatus is a spring-catch, to hold the drums in position while working. Without it, the upper drum when full of water, would not remain above the lower. This catch is freed by pressing on a button when the drums are to be reversed. The operation of reversing takes about a second. As a spring-catch is very easy to make, no detail is given of it in the figure.

Water-trap.—When there is too much water in the drums, and under other conditions, which I have not been able to determine, a little water sputters up with the air, and finds its way to the blowpipe. To prevent this, a trap is conveniently made, as in figure 3, with a glass tube tightly closed at each end by a rubber cork. A tube enters through the middle of each cork, one for the ingress of air from the lower drum, and the other for its egress to the blowpipe. One of the corks is provided with another hole, near its circumference, which may be conveniently closed with a plug of any hard substance, and water may be let out from time to time, by removing this plug. In the bellows I use, the glass tube shown in figure 3 is placed in the hollow journal, H.

COMPOSITION AND QUALITY OF THE METROPOLITAN WATER.

MARCH, 1878.

THE following are the returns of the Society of Medical Officers of Health:—

	Appearance in 2 foot Tube.	Ammonia. Saline.	Ammonia. Organic.	Nitrogen as Nitrates, &c.	Oxygen used to Oxidise Organic Matter.	Total Solids.	Lime.	Magnesia	Chlorine.	Sulphuric Anhydride.	Hardness on Clark's Scale. Before Boiling.	Hardness on Clark's Scale. After Boiling.
		Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Thames Water Companies.												
Grand Junction	Clear	0·000	0·007	0·120	0·051	21·20	8·560	0·540	0·94	1·460	13·7	3·30
West Middlesex	Clear	0·000	0·008	0·105	0·062	21·10	8·400	0·570	0·94	1·830	13·7	3·70
Southwark and Vauxhall	Clear	0·000	0·011	0·120	0·061	20·90	8·560	0·420	0·87	1·660	13·2	3·30
Chelsea	Clear	0·000	0·010	0·120	0·048	20·90	8·840	0·540	0·94	1·660	13·7	2·80
Lambeth	Clear	0·000	0·011	0·114	0·062	22·20	8·900	0·360	0·94	1·800	13·7	2·80
Other Companies.												
Kent	Clear	0·000	0·002	0 195	0·000	26·40	10·440	0·570	1·29	2·860	17·0	4·60
New River	Clear	0·000	0·007	0·134	0·024	20·20	8·900	0·360	0·94	1·160	13·7	2·80
East London	Clear	0·000	0·007	0·105	0·032	22·40	9·120	0·640	1·15	2·000	14·3	4·20

The quantities of the several constituents are stated in grains per imperial gallon.

NOTE.—The amount of oxygen required to oxidise the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the Metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it

C. MEYMOTT TIDY, M.B

CORRESPONDENCE.

BURNARD'S PATENT FOR SUPPLYING SULPHURIC ACID CHAMBERS WITH NITRE.

To the Editor of the Chemical News.

Sir,—The President of the Tyne Chemical Society in his inaugural address, as reported by you in your issue of April 26, makes some criticisms on Burnard's patent for supplying sulphuric acid chambers with nitre in solution, &c.

Permit us to say in reply to Mr. Affleck's observations that, at our Cattedown Works, from their commencement in November, 1876, to the present time (with two very brief interruptions for general repairs), the process has been constantly in use, not a pound of nitre having been potted.

It is silent, continuous, and most effective—the longer we use it the more we are gratified with it.

That imperfect trials, of which the patentee has had no cognisance, may have failed is at once granted, but failure is simply impossible when the apparatus is properly constructed and the details mastered.

To the objection of Mr. Rennoldson, as quoted by Mr. Affleck, we also state as facts that we can and do adjust the steam with the utmost ease and accuracy, and that the strength of our chamber bottoms have all along averaged (within very narrow limits) as follows:—No. 1, 130°; No. 2, 130°; No. 3, 120°; No. 4, 100°. (Twaddel).—We are, &c.,

Burnard, Lack, and Alger.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 14, April 8, 1878.

Extract from a Work Entitled "On the Vision of Colours, and in Particular on the Influence Exerted on the Vision of Coloured Objects in Circular Motion, when they are Observed Comparatively with Identical Objects in a State of Rest."—M. Chevreul.—The author has undertaken the experiments described in his work, because latterly certain *savants* of undeniable merit, in opposition to the ideas of Newton and Arago, have set up the absolutely false hypothesis that the fundamental colours are red, green, and violet, yellow being formed of red and green, and blue of violet and green. The author's experiment are in perfect conformity with the principles of the "optics" of Newton, and with the views of Biot, Arago, and Brewster.

Action of Oxygen upon the Acid Chlorides and Analogous Compounds.—M. Berthelot.—Oxygen displaces chlorine in the perchloride of phosphorus, forming at first phosphorus oxychloride, and finally phosphoric acid. Similar reactions take place with phosphorous chloride, and with the corresponding compounds of bromine and iodine.

Transparence of Coloured Flames.—M. Gouy.—The author's experiments prove the transparence of flame, both for the rays which it emits and for others.

Variation of the Indices of Refraction in Mixtures of Isomorphous Salts.—H. Dufet.—The differences between the indices of a mixture of two isomorphous salts and those of the salts composing it are inversely as the numbers of equivalents of the two salts which enter nto the mixture.

Direct Fixation of Oxygen and Sulphur upon Benzin and Toluen.—MM. Friedel and Crafts.—The general method employed by the authors consists in the use of the metallic chlorides, and in particular of the chloride of aluminium, which serves to attack the hydrocarbon operated upon, and to cause the substitution of one, or of several atoms of hydrogen, by hydrocarbonated or oxygenated groups, or even by elements which are added in the state of chlorides to the hydrocarbide mixed with the chloride of aluminium.

Action of Chloride of Ethyl upon Benzin in Presence of Chloride of Aluminium.—MM. Albright, Morgan, and Woolworth.—The authors have obtained a hydrocarbon corresponding in composition to hexethylbenzin. It crystallises in monoclinar prisms, melts at 123°, and boils at 286°.

On Ergotinin, the Base Present in Ergotised Rye.—M. Tauret.—The composition of this base is represented by the formula $C_{70}H_{40}N_4O_{12}$. Only two of its salts, the sulphate and the lactate, have been obtained in a crystalline state, and not in quantity sufficient for analysis.

Alcoholic Potassa.—E. J. Maumené.—The author maintains that alcoholic solutions of potassa are converted, in course of time, into dihydrodedate of potassa, a neutral anhydrous salt, formed by an acid richer in hydrogen than any other known, $C_4H_8O_4$. This salt is rendered anhydrous by desiccation at 100°. It is deliquescent, especially in moist air, and its solution has a very faint and slightly bitter taste. Its action with metallic salts is very characteristic: if concentrated, it forms in all a magma, very similar to that produced by the mixture of caustic potassa with calcium chloride. If diluted, it precipitates ferric, mercuric, plumbic, and platinic solutions. The ferric precipitate is a yellowish white, and is re-dissolved by boiling with an excess of hydrodedate; that of silver is of a pale yellow, like silver phosphate, but becomes black in a short time. That of platinum (chloride) is the double chloride of platinum and potassium, and its formation is accompanied by a brisk effervescence. The same phenomenon is still more marked with bismuth nitrate where a white precipitate is deposited. Gold chloride gives no precipitate in the cold, but merely a faint brown colouration. On ebullition gold separates out, and the liquid takes a pale violet colouration. Chrome-alum, ammoniacal or potassic, gives a deposit which easily re-dissolves if the chrome is in excess.

Researches on Nitrification by Organic Ferments.—Th. Schlœsing and A. Muntz.—Those vegetable organisms, moulds, and mycoderms which effect so energetically the combustion of organic matter, do not produce nitrification; on the contrary, they transform nitric acid at their disposal at first into organic matter, and then, in part at least, into free nitrogen, the latter phenomenon being often attended with the production of ammonia. They effect, consequently a loss of the combined oxygen existing on the surface of the globe.

Moniteur Scientifique.
March, 1878.

This issue, strange to say, contains no original chemical matter.

April, 1878.

Use of Ammonium Sulphocyanide in Volumetric Analysis.—J. Volhard.—Already reproduced in the Chemical News.

Volumetric Analysis of Phenol.—Dr. W. F. Koppeshega.—The process at present employed for the determination of phenol in creosotic coal-tar oils consists in agitating for some time a known volume in a graduated tube, with a strong solution of caustic potassa, and reading off the volume of hydrocarbides which is gradually deposited. But the decrease of volume is not

a certain indication of the quantity of phenol present. The author has, therefore, devised the following method. The requisites are (1) a solution of sodium hyposulphite, which, in equal volumes, corresponds to a solution of iodine, containing 5 grms. per litre. (2.) A filtered solution of starch. (3.) Bromine-water, of such a strength that 50 c.c., after decomposition by the iodide of potassium solution, require 18—20 c.c. of the solution of sodium hyposulphite. It is preserved in well stoppered bottles, containing at least 500—600 c.c. (4.) A solution of potassium iodide, 125 grms. per litre. A clear solution of the sample of phenol or creosote oil is made by dissolving 4 grms., and making the solution up to 1000 c.c. Of this solution 25 c.c. are transferred, by means of a pipette, into a well-stoppered half-litre flask, which is then rapidly filled up to the mark with bromine-water, stoppered, and shaken for some time. Before adding the bromine-water, however, 50 c.c. of it are conveyed, by means of a pipette, into a beaker, containing 5 c.c. of the solution of iodide of potassium No. 4. After a quarter of an hour the flask is emptied into a large beaker, containing 10 c.c. of the solution of potassium iodide, and the flask is then twice rinsed with water into the beaker. Finally the iodine is determined separately in each goblet, by means of the solution of sodium hyposulphite No 1. The starch water is only added at the end of the operation. The result is read off when the blue colouration no longer reappears after standing for some minutes. If we have used in the determination 25 c.c. of the solution of phenol, containing 0·1 grm. of the sample, adding 475 c.c. of bromine water, and using 50 c.c. for the titration of the bromine water, and determining the quantities of iodine set free by means of the standard sodium hyposulphite No. 1, the calculation will be much simplified by the use of the formula $(9{\cdot}5\ a - b)\ 0{\cdot}61753$; a represents the number of c.c. of the solution of sodium hyposulphite used for determining the strength of the bromine water, and b the number of c.c. which correspond to the excess of bromine in the experiment. The number found shows the percentage of phenol in the sample examined.—*Zestschrift f. Analyt. Chemie.*

Researches on the Aromatic Amines. — MM. Noelting and Boasson. — An examination of dimethyl-paratoluidin, and dimethyl-orthotoluidin. The authors have found, that in the dry distillation of rosanilin, the oils passing over below 220° contain a small quantity of a secondary base, doubtless a mixture of mono-methyl-anilin and toluidin, in consequence of the formation of nitrosamin.

Blue Alizarin.—M. Prud'homme laid before the Société Industrielle de Mulhouse samples of goods dyed and printed with a new product lately offered in the market by the Ludwigshafen Alizarin Works, under the name of "Blue Alizarin." This colour was discovered by M. Prud'homme among the derivatives of monitro-alizarin, but was first isolated and obtained on a commercial scale by M. Brunck. It sublimes in black crystals like those of indigo, giving off violet-red vapours. It is almost insoluble in water, sparingly soluble in alcohol, but more readily soluble in acetic acid. In alkalies it dissolves with a blue colour. Its barytic and calcic salts are a greenish blue. Concentrated acids dissolve it with a fine red colour. Blue alizarin does not dye below 70°, and the process should be pushed to a boil, and is facilitated by adding to the bath either a little soap, or oil such as is used in dyeing Turkey reds. The shades produced with the different mordants are; with alumina, a violet-blue; iron, a greenish blue, chrome, a violet; and tin, a reddish violet. The most useful mordants in printing are ammonium, or potassium ferrocyanide, and chromium acetate. By steaming, a colour of one part alizarin blue with four of thickening yields shades like deep indigo blues, and as with red alizarin the shades are brighter, and fuller upon cloth prepared as for Turkey reds. Goods dyed or printed with alizarin blue resist soap, dilute acids, chlorine, and light very satisfactorily. Wool can be dyed without mordant in an acid bath. One of the most interesting peculiarities of blue alizarin, pointed out by M. Prud'homme, is that it becomes soluble in an alkaline solution, being reduced like indigo. The vat is rose-coloured, and is covered with a greenish-blue scum. Being almost insoluble in water, it is fixed on the fibre as it becomes re-oxidised by the air, and produces blue shades like those of indigo.

Extraction of the Metals Accompanying Platinum at the Gold and Silver Refinery, at Frankfort-on-the-Main.—L. Opificius.—Not suitable for abstraction.

Biedermann's Central-blatt,
Heft 1, January, 1878.

Formation of Hail.—Prof. H. Fritz.—The author assumes that the clouds and watery vapours rise upwards into colder regions, so that the hail granules thus formed descend from a great height, and further, that vesicles or globules of water exist in the atmosphere in a super-refrigerated state.

Influence of "Leaf-wood" in Comparison with Conifers upon the Rain and the Quantity of Moisture in the Air.*—M. Fautrat.—Pine-trees seem to have the greatest efficacy in increasing atmospheric moisture. They retain more than half the rain-fall upon their heads, whilst broad-leaved trees transmit 58 per cent of the atmospheric moisture to the ground. Hence pine-forests lessen the danger of flooding in rivers, which have their source in mountains so planted.

Proportion of Carbonic Acid in the Ground-Air.—P. Smolensky.—The author, from experiments on the air of soils from cemeteries and districts abounding in cess-pools, finds that the carbonic acid in such air shows a distinct relation to the pollution of the earth.

Absorption of Bases by the Soil.—H. P. Armsby.—The absorption of combined bases by the soil consists in an exchange of base between the salt employed and the hydrated silicates of the soil. This exchange is, however, only partial, and varies with the concentration of the solution and with the proportion between the volume of the solution and the quantity of soil used.

Analysis of Soils.—Ad. Mayer. — The author concludes that the determination of phosphoric acid alone gives a good clue to the quality of a soil. If an unfruitful soil contains a fair proportion of phosphoric acid, the cause of its barrenness is probably not the absence of plant-food, but the presence of some positive but less easily detected cause of infertility.

"Beet-root Sickness in Solids."—Prof. J. Fühling.—The incapacity of certain soils to yield good crops of beet-root is ascribed by the author primarily to the exhaustion of the potash, and secondarily to the exhaustion of phosphoric acid.

Action of Nitrogen as Ammonia and as Nitric Acid upon the Crops.—W. Lott and Dr. J. König.—A better crop of rye was obtained by the application of plain superphosphate in autumn, followed by nitrate of soda in spring, than by the use of an ammoniacal superphosphate in autumn.

Manurial Experiments upon Flax.—A. Renouard.—Flax may be more frequently introduced into agricultural rotation without exhausting the soil, if G. Ville's special manure is employed, consisting of 400 kilos. super-phosphate, 200 kilos. nitrate of potash, and 400 kilos. gypsum per hectare.

Injury Done to Forests by Sulphurous Acid.—Dr. J. König.—Trees exposed to the fumes of vitriol works, &c., absorb sulphurous acid by means of their leaves, and

* The Germans apply the term "leaf-wood" to all other trees in contrast with the conifers, which they designate "needle-wood."

are found to contain an abnormal amount of sulphates. Water holding sulphate of zinc in solution extinguishes vegetation wherever it penetrates, the so-called "zinc-violet" forming the sole exception.

Adulteration of Soap.—The following receipt is extracted by *Dingler's Pol. Journal*, from the *New Soap-boiler's Journal* (Neue Seifensiederzeitung):—"Saponify 600 kilos. cotton-seed oil, 200 kilos. tallow, and 200 kilos. bone-oil, with potash-lye at 18° in the usual manner. A thick mixture is then made of solution of potash, potato-flour, and soluble silicate of soda, and two parts of soap are crutched thoroughly up with one part of this mixture, boiled, and mixed with more soda-lye till the total weight rises to more than double that of the fatty matter originally present." *Dingler's Journal* remarks that when trade-organs thus openly recommend sophistication caution is needful on the part of purchasers.

Gazzetta Chimica Italiana.
Fasc. i., 1878.

Formation of the Corresponding Alcohols in the Preparation of Aldehyds on Piria's Method.—Stefano Pagliani.—We may conclude that in the dry distillation of a mixture of a formiate, and of the salt of a fatty acid, there are formed, as necessary products, the aldehyd, and the corresponding alcohol, and that all the hydrogen necessary for the hydrogenisation of the aldehyd is furnished by the formiate.

Researches and Considerations on the Glucosidic Nature of the Natural Tannin of Gall-nuts, and on a Crystalline Substance Obtained by the Action of Arsenic Acid upon Gallic Acid.—Dr. Pasquale Freda.—The author finds that Strecker's equation cannot express the transformation of natural tannin. The substance obtained by the action of arsenic acid cannot be digallic acid. It is very soluble in water, the solution having an acid reaction. If treated with ferric chloride, the solution gives a blue-black precipitate; it precipitates also the solution of isinglass. The dry substance is soluble in ethylic alcohol, absolute or dilute, in ether, in a mixture of alcohol and ether, in methylic and amylic alcohol, in glycerin, potassa, and ammonia, to which two latter liquids it imparts a cinnamon colour. It is insoluble in carbon bisulphide, in oil of turpentine, in benzol, toluol, xylol, chloroform, sulphuric and hydrochloric acids. Its melting-point is constant at 210°.

An Experiment on the Means of Rapidly Evaporating a Large Quantity of Liquid.—J. Brugnatelli.—The author finds that the escape of steam from water boiling in a flask is much increased if there is an open tubulure in the side of the vessel above the surface of the liquid.

MISCELLANEOUS.

Russian Scientific News.—M. Setchenoff has found that the white of eggs, on being boiled in vacuum, turns solid as fibrin. In order to ascertain if the yellow of eggs has some influence on this reaction, experiments were made, and it was found that when a small quantity of the yellow is admixed, the solidification of the albumin, as mentioned above, is five times quicker. This fact, besides being a matter of great importance for physiology, allows us to obtain the albumin in a more pure form.

M. Eremin has made experiments with ozone. He found that in oxalic acid solutions ozone may be preserved longer than while using other fluids for this purpose. Another fact is very remarkable: the decomposition of ozone in sunlight is slower than in the dark; also, ozone which, after preparation, was left for some time, and was not immediately used, had a more energetic action for disinfecting purposes.

S. Kern, M.E.

St. Petersburg.

NOTES AND QUERIES.

Moulding Wax.—Can any of your readers inform me how wax is prepared for moulding and modelling? I have worked up bees'-wax with oil and Venice turpentine, but it sticks to the tool, and is not quite tough enough.—Amateur.

MEETINGS FOR THE WEEK.

Tuesday 21st.—Civil Engineers, 8.
—— Zoological, 8.30.
—— Royal Institution, 3. "On Some Points in Vegetable Morphology," W. T. Thiselton Dyer, M.A.
Wednesday, 22nd.—Society of Arts, 8.
—— Geological, 8
Thursday, 23rd.—Royal 8.30.
—— Royal Institution, 3. "On Colour," Lord Rayleigh, M.A.
Friday, 24th.—Royal Institution, 8, Weekly Meeting. "Geology of Gibraltar, and the Opposite Coast of Africa," Prof. Ramsay, 9.
—— Quekett Club, 8.
Saturday, 25th.—Royal Institution, 3. "On Richard Steele," Prof. Henry Morley.
—— Physical, 3.

TO CORRESPONDENTS.

J. B. Wilkinson.—Apply to the Secretary of the Royal Institution, Albemarle Street, London, W.

T. H. Walker.—Apply to the Secretary, Burlington House, Piccadiliy, W.

Lately published, in one vol. of 1091 pages, with Diagrams and other Illustrations. 8vo. £1 11s. 6d.

EXPERIMENTAL RESEARCHES IN PURE, APPLIED, AND PHYSICAL CHEMISTRY.

By E. Frankland, Ph.D. (Marburg), D.C.L., F.R.S., Professor of Chemistry in the Royal School of Mines, &c.

The work includes investigations on the Manufacture and Illuminating Power of Gas, on the Water Supply of Towns, and the Purification of Drainage from Towns and Manufactories.

Also by Professor Frankland,

LECTURE NOTES FOR CHEMICAL STUDENTS. Second Edition. Vol. I. (Inorganic), 4s. Vol. II. (Organic), 5s.

London: J. VAN VOORST 1, Paternoster Row.

THE TELEPHONE.

Arrangements for Exhibiting or Fixing on application to EDWARD PATERSON, Telegraph Engineer, 3, Bedford Court, Covent Garden, W.C. Insulated Wires, Call-Bells, Insulators, and Galvanised Wire for Overhead Lines. Electric House-Bells, and all descriptions of Electrical Apparatus for experimental and other purposes. Price list post free 2 stamps.

A Gentleman (age 25) who has studied Chemistry at King's College, London, and also at the University of Göttingen, and has had considerable experience in connection with the manufacture of iron and steel, is seeking an engagement as Chemist or Assistant; has good references.—Address, H., care of the Secretary of the Society of Arts, Adelphi, London, W.C.

Wanted, to Purchase, a Small Analytical Practice. Principals only dealt with.—Address, N. R. E., Chemical News Office, Boy Court, Ludgate Hill, London, E.C.

To be Sold, by Private Contract, an excellent and old-established Chemical Manufacturing and Drysalting Business, together with extensive works at Manchester, Glasgow, and Ayr. The business is a very lucrative one, and is in full working order. The sole reason for selling is the death of the last surviving partner. Only principals or their solicitors will be treated with.—Apply to Slater, Heelis, and Co., Solicitors, 75, Princes Street, Manchester.

TO BE LET, in a commanding situation in the main street of Keighley, a Good Shop (Plate Glass Front), with House attached, containing Six Rooms. A good opening for a Chemist and Druggist.—For rent and particulars apply to John Smith, Liverpool House, Keighley.

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy. "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

ENLARGEMENT OF "NATURE."

NATURE:

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE.

FROM May 2, the commencement of a new volume, NATURE was enlarged and the price raised to 6d.

This step has been necessitated by the success which has been achieved during the period, upwards of eight years, which has elapsed since the journal was first started, a success due to the generous response which has been made to the endeavours to obtain the earliest information on all affairs touching scientific progress from all parts of the world.

The quantity of important matter now received during each week from both hemispheres so largely exceeds the space at present at the Editor's disposal, that as an inevitable result the publication of valuable new results and interesting information is often delayed for a considerable time.

This large increase is mainly due to the formation of new scientific societies and associations both in our own and other countries, and to the valuable aid afforded us by our subscribers and readers, some of them in the more remote and least known spots on the earth's surface.

The following list of places from which we occasionally receive correspondence will give an idea of the manner in which NATURE now circulates in regions far outside the range of the ordinary newspapers:—Itajahy (South Brazil), Samoa, Borneo, Graaf Reinet (South Africa), New Guinea, Johore, Champion Bay (Gulf of Siam), Nukus (Amu Delta), Dehra Doon (North-West Provinces), Philippine Islands, Willunga (South Australia), Puerto Plata (Sto. Domingo), Saigon (Cochin China), Hailer Grace (Newfoundland), Manado (Celebes), Pietermaritzburg (Natal), Kaffraria, Ohinitahi (New Zealand), Jask (Persian Gulf.) We might have largely increased this list had we given the names of the many other places in India where we have either regular or occasional correspondents, besides places in China, Japan, remote parts of America, Australia, and New Zealand.

Nor must we omit to state that from the United States in which NATURE circulates more widely than any other English journal, we receive early proofs of many of the valuable contributions to scientific theory, exploration, and practice, the rapidly increasing number of which is one of the most remarkable indications of scientific progress to be noted in our time.

We have, it need scarcely be said, regular Correspondents in all the principal countries of Europe, and as our pages testify, our reviewers and other contributors are not confined to English men of science. We are gratified to state that we are able, when we deem it advisable, to be the medium of communication of the opinions of the most eminent men of science in Europe and America on any important subject attracting general attention. Any one looking over the seventeen volumes of NATURE will find there as contributors, at one time or other, the most prominent names of our time.

That NATURE has thus been able to attract to her pages as contributors or correspondents, not only the leading scientific men of all countries, but many others who quietly cultivate science in their leisure hours in the most remote parts of the world, and that a love for science is spreading more and more appear to the proprietors to indicate that in its new form NATURE will prove more attractive and useful, because fuller and more varied, than ever.

PUBLISHED EVERY THURSDAY AFTERNOON, PRICE SIXPENCE.

Subscriptions:—Yearly, 28s.; Half-Year, 14s. 6d.; Three Months, 7s. 6d.

OFFICE: 29, BEDFORD STREET, STRAND.

Just published, 2nd Edition, 594 pp., 8vo., price 12s. 6d.

ORGANIC MATERIA MEDICA.

By DR. MUTER.

Analytical Chemists will find this a concise and yet complete book of reference for the isolation and examination of the active principles of drugs. Special appendix on the microscopic characters of the starches in food and drugs. Copious index and qualitative courses for resins, &c.

Published by W. BAXTER at the Office of the South London School of Pharmacy, Kennington Cross, S.E., and sold by Messrs. Simpkin and Marshall and Messrs. Baillière, Tindal, and Cox.

APPARATUS AND CHEMICALS

FOR USE IN

LABORATORIES, LECTURE-ROOMS, AND SCIENCE SCHOOLS.

M. JACKSON & CO.,

65, BARBICAN, LONDON, E.C.

MANUFACTURERS AND IMPORTERS TO THE TRADE.

Revised Price List (containing the latest reductions in price to July, 1877) sent post free on application.

JAMES WOOLLEY, SONS, & CO.

69, MARKET STREET, MANCHESTER,

DEALERS IN

CHEMICAL AND SCIENTIFIC APPARATUS CHEMICAL REAGENTS, &c.,

FOR THE USE OF

ANALYSTS, SCIENCE TEACHERS, AND MANUFACTURERS

Price Lists on application

BISULPHIDE OF CARBON,

CHLORIDE OF SULPHUR.

GAS PURIFICATION & CHEMICAL CO., LIMITED,

161, 162, 163, PALMERSTON BUILDINGS, LONDON, E.C.

THE NEW MINIATURE SPRENGEL PUMP.

(STEARN AND SWAN'S PATENT.)

As Exhibited and Approved at the late meeting of the British Association (Plymouth).—Can now be obtained of MAWSON and SWAN, Newcastle-on-Tyne. Full particulars on application.

THE CHEMICAL NEWS.

Vol. XXXVII. No. 965.

SULPHATE OF SODA.*

By JOHN AFFLECK, M.A., D.Sc.

(Continued from p. 171.)

Since Messrs. Jones and Walsh introduced their mechanical decomposing furnace some eighteen months ago, a rather lively interest has been manifested in this department of the process. A number of our leading chemical manufacturers lost no time in proceeding to Middlesbrough to see for themselves the new wonder which had arisen in the east. A short inspection seems to have sufficed to convince most of them that the thing was as good as it was represented; in fact, that the new furnace was in every respect a perfect success, and would prove a valuable acquisition to the trade. The glowing accounts of its capabilities which they brought back to their brethren on the Tyne, led to a paper being read on the subject before the Newcastle Chemical Society by Mr. Clapham. In the discussion which followed the reading of this paper the main difficulties and weak points of the new invention were either completely ignored, or tackled with but little spirit, by the manufacturers present. Some doubts were, indeed, timidly expressed as to the furnace being so admirably adapted as was stated, for giving easy and perfect condensation. But on every other point criticism seems to have been disarmed. Each succeeding speaker rose to still higher encomiums, and all was *couleur de rose*. In short, before separating, they had got up the weekly production to, at least, 100 to 120 tons, with no appreciable wear and tear of any part—no nuisance from gas escapes or "green" batches—great saving in sulphuric acid—a perfect condensation of the hydrochloric acid—fuel, a mere trifle—wages, not worth mentioning. The next step was a rush to have the first Jones' furnace built and working on the Tyne, each manufacturer making a few modifications or prospective improvements on the original to suit his own fancy. But a few weeks' trial was quite sufficient to show that the expectations that had been raised regarding the performance of this furnace were most extravagant, and doomed to bitter disappointment. And then some of its quondam panegyrists did not hesitate to run to the other extreme, and declare the whole thing a miserable failure. This by no means accords with the view I have taken of the case. It must be admitted, I think, on the one hand, that the machine invented and patented by Messrs. Jones and Walsh for performing this step in the alkali process—a step involving the most severe and the most disagreeable sort of manual labour—is far from being all that could be desired; and also that the actual results obtained in working it on the Tyne have been, in nearly every case, most disappointing hitherto. But, on the other hand, we are bound to acknowledge that, while previously only a few feeble and spasmodic attempts had been made at rare intervals to invent a machine for this purpose, Messrs. Jones and Walsh have earned the distinction of being the first to produce one that, with all its defects, is undoubtedly able to do the sort of work required in a very superior manner, and more economically than it could be done hitherto by hand-worked furnaces.

Some eight of these furnaces have been built on the Tyne, nearly all on different plans; and it is no doubt true, as the patentees aver, that the irregularities in working, frequent break-downs, and small outputs of most of these furnaces have been, in some degree at least, due to this fact, that manufacturers would insist upon making various alterations in the original plan before they had the slightest experience to help them to do so judiciously. Only *two* firms, so far as I know, have hitherto succeeded in getting anything like regular working, or an output approaching to what was anticipated from these furnaces. I mean the St. Bede Chemical Company, at East Jarrow, and Messrs. Muspratt, Bros., and Huntley, at Flint. In these cases, I understand, about 70 tons per week of sulphate of soda has been got with some degree of regularity. All the rest, at least on the Tyne, have led a very chequered and precarious existence, rarely able to keep going for many weeks, or even days together, without some more or less serious break-down of the machinery; and when fortune was propitious, and they got a clear week's run, turning out only 30 tons to 40 tons of sulphate. Though many stoppages have been caused by fractures of various parts of the driving gear, the most serious and discouraging ones have been due to such causes as snapping of main vertical shaft or cross arms inside the furnace, cracks in the pan segments, and leakages of acid through them, or over the edges, or through the bottom joints. Some pronounce the burning down or breaking of the arms the greatest drawback of the furnace. Others, who have taken more precautions against that, find the leakage through the bottom joints an almost insurmountable difficulty. Of the eight furnaces that were built on the Tyne, I understand that three have been already worn out and abandoned. One of these, however, namely that at Messrs. Imeary's Works, Heworth Shore, has been replaced by one built and worked by the patentees themselves. This latter has now been working very satisfactorily for three or four months without a stoppage or hitch of any sort, giving a steady output of about 7 tons of sulphate in the twenty-four hours, and taking a charge of 4½ tons to 5 tons of salt at a time. In this furnace, the patentees have introduced peculiar box and expansion joints, covering the ordinary joints of the bottom segments as an additional precaution against leakage. I believe they have had the desired effect. Another of the eight furnaces has never been started at all; while the remaining four are working with more or less success and regularity, turning out from 40 tons to 70 tons per week.

Messrs. Black and Hill have recently patented a modification of the Jones's Decomposing Furnace, the apparatus for which is at present being erected at the St. Bede Works, and will be ready to start work very soon. It consists in adding to the Jones's pan a large solid metal pot to receive the batch of salt and acid in the first instance, and prepare it for the subsequent roasting and finishing operation to be carried out in the Jones's furnace; it fact, to bear the same relation to it as the pot does to the roasting bed of the ordinary hand furnace. This pot is to be about 12 feet long, 6 feet broad, and 4 feet to 5 feet deep, covered by a brick arch, and fired from below as usual. The mixture of salt and acid is to be worked mechanically by paddles fixed on a horizontal arm, caused to rotate near the bottom by spur gearing; and, when properly stiffened, it is to be discharged by the same means through an opening, closed by a sliding door, into the mechanical roaster. Waste heat of pot and roaster are both to be utilised in drying and heating up salt and acid previous to being charged. I hope Mr. Hill will give us some account of the working with this new arrangement of plant.

It seems, at first sight, that to give up in this way the principle of performing the whole operation in one vessel, and to add another heavy metal vessel and more machinery to that already required for the single Jones's pan is going in the wrong direction, and that, by complicating the operation, it will be sure to render it more expensive. but, on the other hand, it may be urged that by dividing the operation into two stages, as in the ordinary hand furnaces, the following advantages will be gained:—

* Inaugural Address to the Tyne Chemical Society, delivered October 12, 1877.

(1.) A greater output of sulphate in proportion to the capital expenditure on the plant employed.

(2.) A saving of fuel, by effecting the evaporation of the water and the bulk of the decomposition by bottom heat.

(3.) A saving of acid, by withdrawing the greater portion of it from the action of the fire.

(4.) Easier and better condensation, by employing a close pot, thus obviating one of the chief objections to the ordinary Jones furnace.

(5.) Doing away with the difficulty of keeping the joints of the Jones's pan tight enough to hold in acid, and rendering it less liable to damage by cracking than in the present method of working, where large quantities of cold salt are suddenly dropped upon the highly heated bottom.

The short experience we have already had of these mechanical furnaces may, I think, justify the following general conclusions:—

(1.) The production of salt-cake by mechanical decomposition of salt is now an accomplished fact, practicable on the large scale.

(2.) It is probable that the operation will be more regularly and also more economically conducted in two separate furnaces—a close pot and open roaster.

(3.) The present Jones's furnace effects with difficulty and with an undue expenditure of time and fuel the decomposition of the last portions of salt and bisulphate. To render the decomposition complete in a reasonable time, the temperature requires to be raised too high for the safety of the machinery as at present constructed.

(4.) A revolving furnace, like the Mactear carbonator, will most probably effect the second part of the operation more rapidly and with less fuel, by exposing the charge more uniformly to the action of the fire; and, at the same time, with less danger of burning down the internal working gear.

(5.) The mechanical furnace will effect a saving in the cost of labour, to the extent of at least one-half, or probably more, over the hand furnace.

(6.) The saving in fuel claimed by the patentees for the Jones furnace has not hitherto been clearly established.

(7.) A considerable saving in sulphuric acid is already shown, and will be still greater if the close pot is adopted. In the old way of working on the Tyne, with open roasters, 5 per cent to 7 per cent, at least, of the acid run into the pot is volatilised by the very imperfect turning over of the charge in the roasting bed, and the consequent over-heating of portions of it before the decomposition of the whole is sufficiently advanced. By the mechanical furnace this loss should be reduced to 1 per cent, or 2 per cent at most.

(8.) The lasting power of all the furnaces hitherto built on the Tyne is very doubtful. Wear and tear is very heavy if the furnaces are pressed to a full red heat. All the details of the construction clearly require a great deal of revision before attaining the form that, for least outlay, will work and heat the materials most economically, while exposing its own working parts to the least action of the fire.

(9.) The quality and amount of the condensation from these furnaces has not yet been satisfactorily shown. A longer experience of their action and more careful observations are needed to enable us to judge how far the more gradual evolution of the gas, said to take place, counterbalances the disadvantage of the open pan for condensation.

(10.) In working mechanical decomposers, whether close or open, there will be a great advantage in using the strongest sulphuric acid possible, in order to minimise the loss of acid in the evaporation of the water. This will necessitate greater attention being paid to prevent radiation of heat from pyrites burners, in order to obtain the full concentrating effect of the hot gases in the Glover towers.

Another very remarkable salt decomposing machine has recently been patented by Messrs. Cammack and Walker, of St. Helens. This aims at making the process a perfectly continuous and automatic one, the machine being constructed to feed the salt and acid into the furnace at one end in a constant stream, to work them as they pass through, and finally to deliver them at the other end in the shape of finished salt cake. This is the perfect "beau ideal" of a decomposing furnace. But, unfortunately, the mechanical difficulties to be overcome in attempting to carry out in practice such an idea are great in proportion to the ambitiousness of the attempt.

The arrangement consists of a metal cylinder, about 20 feet long and 3 feet or 4 feet in diameter, carried horizontally by friction rollers at each end, caused to revolve by suitable spur gearing, and enclosed for the most part in a square fire-brick furnace, which effects the heating of the charge from the outside. The ends of the cylinder are closed by metal plates, which are fixtures, and bear flanges, within which the cylinder freely revolves. At the end farthest from the fire is the salt hopper, from the bottom of which a straight metal pipe passes through the end plate into the cylinder. An endless screw, working in this pipe, and driven by a belt off the main driving shaft, carries the salt continuously into the furnace; while the acid arrives by a small lead pipe debouching immediately behind the screw, and gets thoroughly mixed with the salt before entering the cylinder. Two shafts pass through the cylinder parallel to its axis. One is fixed, provided with teeth to scrape the sides, and prevent the materials adhering in caked masses. The other is made to rotate in the opposite direction to the cylinder, by means of another sheave driven off the main shaft. This movable shaft carries "pitched" teeth or stirrers to stir up and mix the materials, and move them regularly forward towards the delivery end next the fire. The gas evolved is conducted by a pipe leading out of the feed end into a series of 12" vertical glass pipes, where it is condensed by spray jets. Being practically pure hydrochloric acid entirely free from all products of combustion and atmospheric air, 56 feet of such pipes have been found quite sufficient for total condensation.

Till very lately, this furnace has only been tried at the Marsh Alkali Works, Widnes. There it was abandoned after a short trial, as I have been informed by Messrs. Golding and Davis, on account of the mechanical difficulties connected with it. The chief of these they found to be the "sagging" of the two long horizontal shafts passing through the cylinder, under the action of the heat; it being impossible to get any centre bearings for them. This resulted in the blades or scrapers not doing their work properly, so that the salt cake accumulated on the sides was not uniformly pushed forward, and choked up the cylinder.

Quite recently, I understand, Messrs. Gaskell, Deacon, and Co., of Widnes, have taken up this furnace as peculiarly suitable for their chlorine process. They have now one at work; so that we may expect soon to see how far the mechanical difficulties of the continuous decomposing furnace may be overcome by the aid of skill and capital.

Before proceeding to the consideration of the *direct* process for manufacturing sulphate of soda, permit me to say a few words on one point connected with the old decomposing plant. You are aware that several objections are taken to the "close roasters" so invariably used in the Lancashire district. Of these, not the least important, is that founded on the loss of work, expense of repairs, and gas nuisances caused by the frequent leakage of HCl into the smoke flues through cracks in the inner arch, or in the working bed. Now this objection seems to be in a great measure obviated by the gas-fired furnaces introduced, some years ago, by Mr. Gamble, at St. Helens. Heating in this way, the pressure in the combustion flues can easily be kept greater than, or at least equal to, that of the working bed, so as to prevent gas from passing through cracks or fissures from the latter into the former. If any mixing of the two currents of gas should take place owing to defects in the brick-work of arch or bed, smoke will

pass from the fire flues into the roasting bed, not HCl into the fire flues, and thence escape to the chimney. Hence, with such furnaces, very little attention need be given to the state of the inner arch. In fact, I was told that at Messrs. Gamble's they often go on working a furnace for weeks, with a brick or two dropped out of it.

It seems to me rather strange that both gas producers and close roasters should still find no support on the Tyne.

I may also mention that the Messrs. Deacon, at Widnes, are now aiming at producing the same effect in the fire flues as I have described, without using gas, by sinking the fire-place some 7 feet or 8 feet below the working bed. This plan, however, will cause a good deal of inconvenience, and extra labour in firing.

(To be continued.)

A STUDY OF PLAT-AMMONIA COMPOUNDS.

By SAMUEL E. PHILLIPS.

Some thirty years ago Laurent and Gerhardt sought to explain the salts obtained by Magnus, Gros, Raewsky, Reiset, and others, by supposing two platinums of mono- and diatomic weight, calling the former platinicum and the latter platinosum. An attentive study of the real chemism of those researches then revealed the simple and welcome fact that one equivalent weight of platinum was alone sufficient, with the ordinary condensations of ammonias, varied with certain *forced* reactions by which binoxide, bichloride, and oxychloride bases were produced.

In 1870 Prof. Odling gave a studied outline of those compounds, adopting somewhat of the ideas and nomenclature of those great men whose talent and audacity have exerted so great an influence on chemical philosophy to this day. He has one double equivalent or diatomic weight of platinum, which, however, does double duty, replacing either two or four equivalents of hydrogen, and the following groups are curiously equivalent or replace each other :—

$$2HCl = 2HCl.$$
$$2H(HO) = 4HO.$$
$$2H(NO_3) = 2HO.NO_5.$$

Taking the chlorides as typical of their series, they have some curious ratios :—

I. The platosamines—
$Pt''(H_2N)_2.2HCl = H_6N_2.2HCl = H_8N_2,Cl_2.$

II. The amo-platosamines—
$Pt''(H_5N)_2.2HCl = H_{12}N_4.2HCl.$

III. The platinamines—
$Cl_2Pt''''(H_2N)_2.2HCl = H_{10}N_2.2HCl.$

IV. The amo-platinamines—
$Cl_2Pt''''(H_5N_2)_2.2HCl = H_{16}N_4.2HCl.$

V. The amo-di-platinamines—
$Cl_2OPt''''(H_5N_2)_4.4HCl = H_{32}N_8.4HCl.$

In III. Cl_2 is replaced by $(HO_2)_2$ and (NO_6).
In IV. Cl_2 „ „ $(NO_4)_2$.
In V. Cl_2 „ „ $(NO_6)_2$!

These numerical anomalies have not passed unnoticed by the great intellects devoted to a continuation of this wanton system of guessing and hypothesis, where the simple chemism of the subject is so fatally obliterated. (For a comparative analysis of the Odling outline see Chemical News, vol. xxii., p. 49.)

For the further ingenuity displayed we can well refer to the latest aspect as given by Watts in the recent edition of Fownes's invaluable epitome of modern chemistry. The same five groups are essentially preserved, and new names and radicals are curiously invented to lessen the anomalies referred to.

Again taking the chlorides as typical of their series we have—

I. Diammonio-platinous compounds—
$2NH_3Pt''.Cl_2 = H_8N_2.Cl_2.$

II. Tetra-ammonio-platinous compounds—
$4NH_3Pt''.Cl_2 = H_{14}N_4.Cl_2.$

III. Di-ammonio-platinic compounds—
$2NH_3Pt''''.Cl_4 = H_{10}N_2.Cl_4.$

IV. Tetra-ammonio-platinic compounds—
$4NH_3Pt''''.Cl_4 = H_{16}N_4.Cl_4.$

V. Octaminio-platinic compounds—
$8NH_3Pt_2.Cl_8 = H_{32}N_8.Cl_8.$

Taking R to represent Cl or its supposed equivalents, it is curious that all the latter series are given as R_6O_{11}. Excepting II. and III., which are doubly anomalous in their ratios, here is the fashionable mistake of supposing that condensed ammoniums are $n(H_4N)$, and their chloride or acid elements are di, tri, tetra, penta, or octa, as determined by the number of N or analogous equivalents.

To such as can appreciate the overwhelming number of plain facts, I have demonstrated the absurdity of both these hypotheses. A condensed ammonium is in principle and fact precisely what any other condensed radical is, and all are subject to one pervading law, not only in the genetic mechanism of their production, but in the controlling limits of their variations or departures from normality.

In I. and IV. it is alleged that platinum replaces 2H in the former and 4 in the latter, while in III. the bivalent radical, $(Pt''''Cl_2)''$, plays the same part as Pt'' in the first series.

Against this tirade of assumption we have ever reiterated that the metals platinum, gold, copper, iron, and potassium, &c., replace one H with all the certainty of established law, and strange indeed is it that they who deny the free existence of the first and best known radicals should now reveal the secret "hocus pocus" by which, with a practised ingenuity, any number of radicals, with any required valency, can be manufactured *on paper!*

The Pt molecule generally has two affinities, hooks, or points of attachment, and when required we can draw it with four such attractive appendages, and after hanging chlorine on two of these hooks, we then have two free affinities, and therefore a bivalent radical $(Pt''''Cl_2)$!

A Nero fiddling over a Rome in flames can scarcely be more reprehensible than such trifling as this in presence of the increasing demand for the bread of knowledge. We now give a list of these compounds, eschewing hypothesis as much as possible, and reducing all alike to their lowest or simplest atomic quanities :—

I. $2NH_3Pt''.Cl_2 =$

The chloride	..	PtH_3N,Cl or $PtH_6N_2,Cl.PtCl$.
The oxide	..	PtH_3N,O.
The hydrate	..	$PtH_3N,O.HO$.
The sulphate	..	$PtH_3N,O.SO_3$.
The platinate	..	$PtH_3N,Cl.PtCl_2$, &c.

II. $4NH_3Pt''.Cl_2 =$

The chloride	..	PtH_6N_2,Cl or $PtH_{12}N_4,Cl.PtCl$.
The oxide	..	PtH_6N_2,O.
The hydrate	..	$PtH_6N_2,O.HO$.
The carbonate	..	$PtH_6N_2,O.CO_2$.
The platinate	..	$PtH_6N_2,Cl.PtCl_2$, &c.

III. $2NH_3Pt''''.Cl_4 =$

The chloride	..	PtH_3N,Cl_2 or $PtH_6N_2,Cl_2.PtCl_2$.
The oxide	..	PtH_3N,O_2.
The sulphate	..	$PtH_3N,O_2.SO_3$.
Another	..	$PtH_3N,O_2.2SO_3$.
A nitrate	..	$PtH_3N,O_2.NO_5$ (*a*).
The nitrate	..	$PtH_3N.O_2.2NO_5$ (*b*), &c.

IV. $4NH_3Pt''''.Cl_4$ =

The chloride.. ..	PtH_6N_2,Cl_2 or $PtH_{12}N_4,Cl_2.PtCl_2$.
The oxide	PtH_6N_2,O_2.
The nitrate	$PtH_6N_2,O_2.NO_5$.
The oxalate	$PtH_6N_2,O_2.C_2O_3$.
The platinate ..	$PtH_6N_2,Cl_2.PtCl_2$, &c.

V. $8NH_3Pt_2''''.Cl_6O_{11}$.

The oxychloride ..	PtH_6N_2,Cl_2 or $PtH_{12}N_4,OCl.PtCl_2$
,, ,, ..	$PtH_6N_2.OCl$.
	&c. &c.

In addition to the reservations and statements made (vol. xxii., p. 49) we now offer a few brief remarks on these series.

There are strong reasons why the platosamines should be regarded as mono rather than diamines. First, that as alleged, they *all* have two atoms of acid, and the elements of two atoms of base, in such way as is quite incompatible with a true diamine. Secondly, that no evidence has been afforded of their diamine character. On the contrary, the "amo-platosamines" have the elements of two diamines, fully borne out by the conditions specified in their production. The hydrate of the former is a strong base with alkaline reaction, absorbing carbonic acid from the air, and liberating ammonia from its salts. The oxide is obtained by heating the hydrate to 110°. The bromide and iodide of the second series are obtained from the sulphate with bromide and iodide of Ba, and they crystallise in cubes. The oxide is a crystalline mass, strongly caustic, and alkaline like potash. It forms two carbonates, an acid and a neutral salt, and the sulphate and nitrate are good crystalline salts.*

III. *Of the Platinamines (Gerhardt).*

The chloride is produced by passing chlorine into a boiling solution of the first chloride (I.), and what more simple or likely could be the reault? But the strong argument chiefly lies in the diminished basic characters of all such dioxy- or dichloro-derivatives.

"An oxy-nitrate," $N_2H_6Pt''''(NO_3)_2O''$ (*a*), is obtained by boiling the chloride for several hours with solution of silver nitrate, "a yellow crystalline powder," sparingly soluble.

"The normal nitrate" (*b*) is specially interesting as illustrating a feature which otherwise is strangely omitted in Watts's recent outline; but the fact is patent to all who can observe widely and apart from hypothesis that where proto-bases are inclined to a non-acid behaviour di-bases are disposed to take up two atoms of acid. And in this respect the older lists are fuller and more instructive than the new, as having less of hypothesis and numerical distortion. It is also worth notice that upon the modern or doubled view my nitrates and di-nitrates would be di and tetra, which is most unlikely; and if my ammonium ratios be true and valid all the binoxide and bichloride salts would become tetra-oxide and tetra-chloride bases, which is intensely absurd.

IV. *Of the Gros Series.*

The chloride here is produced precisely by the same forced chlorination as the former, that on I., this on the chloride II. The oxide of this series has not been isolated, and when treated with silver nitrate the chloride easily gives up its extra atom of chlorine. The chloro-bromide has been prepared, and several similar salts:—

"A nitrato-chloride"	$PtH_6N_2,OCl.NO_5$ (*a*)
"A sulphato-chloride"	$PtH_6N_2,OCl.SO_3$
"An oxalo-chloride"	$PtH_6N_2,OCl.C_2O_3$
"The oxy-nitrate"	$PtH_6N_2,O_2.NO_5$ (*b*)

V. *Of the Raewsky Salts.*

The typical chloride is probably, or at any rate contains, the elements of chloroplatinate of a tetra-ammonium with an oxychloride base. But even this admits of an isomeric alternative, and these salts generally are, in all probability, feeble di-combinations of the previous series. "The oxy-nitrate is otherwise called "an oxy-nitrate or basic nitrate, which we regard as a sesqui-nitrate—

$$2(PtH_6N_2,O_2).3NO_5.$$

But why a larger proportion of acid should lead to such a name is one of the curiosities of nomenclature. A "nitrato-oxychloride" contains the elements of—

$$\left.\begin{matrix}PtH_6N_2O_2.NO_5\\PtH_6N_2OCl.NO_5\end{matrix}\right\} = (a) \text{ and } (b).$$

It was obtained by boiling the chloride I. with large excess of nitric acid, and similar salts have been obtained with carbonic and oxalic acid,—

$$\text{The carbonate} \left\{\begin{matrix}PtH_6N_2O_2.CO_2\\PtH_6N_2OCl.CO_2\end{matrix}\right.$$

$$\text{The oxalate} \left\{\begin{matrix}PtH_6N_2O_2.C_2O_3\\PtH_6N_2OCl.C_2O_3\end{matrix}\right.$$

And a—

$$\text{"Basic-oxalo-nitrate"} \left\{\begin{matrix}PtH_6N_2O_2.2C_2O_3\\PtH_6N_2OCl.NO_5\end{matrix}\right.$$

Old chemists used to think that two atoms of acid made an acid salt, but the reverse is only one of the vagaries of modern chemistry. It is severely tasking our feeble evolution of the simple principles of mineral chemistry to unwillingly force us into a region of slende affinities, such as abounds in mineralogical complexities but the effect can only be to exalt our conception of the great predominance of electro law, extending so far as it does towards the region where all types and ratios are lost in mere mechanical admixture.

Again referring to the first chloride (I.) with its isomers, the same peculiarities have been observed with the corresponding palladium chlorides, and Hugo Müller offers an explanation of the red and yellow isomers. He regard the red as palladium ammonium chloride, $2NH_3.PdCl_2$ the yellow as palladiammonium chloride, $N_2H_6.PdCl_2$ Now in sight of the permutations of a few integers, is it cause for gratulation that such a play upon names and atoms can be regarded as satisfactory? Why not invert the names and types, and why should either be a true representation? The yellow body is seen in its decided basic history. "It gives an oxide which is a strong base, soluble in water, with strong alkaline taste and reaction, absorbing CO_2 from the air, &c. Hence our estimate as PdH_3N,Cl. It also gives $[N_2H_4Pd''(NH_4)_2]Cl_2$ = PdH_6N_2,Cl, and many other salts of both the mono- and diamine series. It is not for me to say what the red isomer may be, as in the Pt analogue there are three isomers, but it is easy to foresee that they may be polymers or chlorhydrates, which may admit of easy identification.

If Pt be *bivalent* in series I. and II., and *quadrivalent* in III. and IV., between which I see no difference whatever as affecting the Pt element, it is curious to divine what may be the explanation of some future time, when monad and triad replacements of H are seen to evince the same behaviour.

It is already quite clear that sulphates of ethylen and platinous diamines are isomorphous, and that between the replacements of gold, ethyl, and potassium there no essential difference of type:—

AuH_3N,Cl	AuH_6N_2,Cl
PtH_3N,Cl	PtH_6N_2,Cl
$(C_4H_3)H_3N,Cl$	$(C_4H_3)H_6N_2,Cl$
$(C_4H_5)H_3N,Cl$	$(C_4H_5)H_6N_2,Cl$

Let ethylen or some negative amine or diamine be treated as the corresponding Pt amines have been, and who can doubt the certainty of the corresponding character and typical results?

In another short paper we propose to entertain three inferential aspects arising out of this research, which may be considered of great interest to such as look forward to a simpler and brighter chemical philosophy.

* It may also be observed that in many cases these salts give off ammonia with a reversion to series I.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, May 16, 1878.

Dr. J. H. Gladstone, F.R.S., President, in the Chair.

After the confirmation of minutes, &c., the following certificates were read for the first time:—W. R. Crisper and C. T. Macadam. The following gentlemen were elected Fellows of the Society:—J. W. Knights, J. H. Wilson, H. R. Smith, G. A. George, F. Slinger, W. Jago, H. W. Jones, A. E. Tucker, B. Gregory.

The first paper was read by the Secretary, "*On the Detection and Estimation of Free Mineral Acids in Various Commercial Products*," by Peter Spence and A. Esilman. The method is based on the fact that peracetate of iron even in dilute solutions has a distinct yellow colour, not perceptibly altered by acetic acid or solutions of persulphates, but instantly bleached by free sulphuric, hydrochloric, and nitric acids. The solution is made by dissolving 10 parts of iron alum and 8 parts of crystallised acetate of soda in 100 parts of a 8 per cent solution of acetic acid (25 per cent). The method is especially suited for alum cake, salt cake, &c. 200 grs. of the sample are triturated in a mortar with 8 per cent solution of acetic acid, and peracetate solution added until the mixture has a decided yellow tint, showing that all the free acid has been neutralised. The liquid is then diluted to 100 measures with the acetic acid water, and a portion filtered into a test-tube. In another test-tube as many measures of the peracetate solution as have been used for the above liquid are diluted up to about 80 measures with the acetic acid water. Standard sulphuric acid is then run in until the colour of the liquid is the same as that of the 100 measures in the first test-tube. The quantity of acid used is the measure of the free acid in the cake.

The second paper was read by the Secretary; it was entitled "*The Action of Hypochlorites on Urea*," by H. G. H. Fenton. The author has found that when urea is acted upon by a hypochlorite in the cold in the presence of a caustic alkali only half the nitrogen is evolved. Thus the mean of eighteen experiments gave 18·22 per cent nitrogen, theory requiring 37·3. Several samples of hypochlorite and various specimens of urea were tried, but all gave the same results. If an alkaline carbonate be used in place of a caustic alkali the whole of the nitrogen is evolved. Thus 0·10303 grm. urea gave 35·3 c.c. N when sodium carbonate was present, but only 19·02 in the presence of caustic soda, theory requiring 38·4. The author then made some experiments to find out what became of the remaining half of the nitrogen. He concluded that it was neither present as urea nor as an ammonia salt, but as a cyanate, the reaction being—

$$2N_2H_4CO+3NaClO+2NaHO=$$
$$=2NaCNO+N_2+3NaCl+5H_2O;$$

further experiments completely confirmed this conclusion. The author states that this reaction may throw light on the constitution of urea, and affords an easy method of detecting and approximately estimating urea in the presence of ammonia salts. There is a mean loss of 2½ per cent of N in all hypochlorite reactions with urea, and of about 8 pera cent in hypobromite reactions, with ordinary apparatus.

Dr. Russell said that some experiments which he made with Dr. West confirmed in the main the author's results; he was surprised to hear the large suppression of nitrogen when the action took place in the cold. Hippuric acid when pure gives off no nitrogen; this fact has lately been confirmed by Dr. Gamgee. Ammonia salts give off all but the theoretical yield. Oxamide is by no means completely decomposed.

Dr. Armstrong pointed out that the above results seemed to favour the constitutional formula of urea suggested by Gamgee and Wanklyn,—

$$C\begin{cases}NH_2\\NH\\OH\end{cases}$$

It must be recollected, on the other hand, that oxamide does not give off all its nitrogen.

Prof. Foster said that he could confirm Dr. Russell's statement as regards oxamide, which gives off only about three-quarters of its total nitrogen. He called attention to the importance of using hypobromite solution quite freshly prepared.

The next paper was read by the Secretary, "*On the Behaviour of Metallic Solutions with Filter-paper, and on the Detection of Cadmium*," by T. Bayley. The author found by quantitative experiments that filter-paper has the power of withdrawing silver salts from solution. Some experiments by Mr. Weston prove that the same action takes place between filter-paper and mercury salts. The author then investigated the action which takes place when drops of metallic solutions are placed on filter-paper, the extent to which the solutions spread being tested by the action of sulphuretted hydrogen. In some cases the solution seemed to concentrate itself in the middle of the spot, and in other cases in a ring round the edge of the spot. The degree of dilution, temperature, and the kind of paper used have an important influence on this phenomenon. Thus, a strong solution of cupric sulphate distributes the copper all over the spot; dilute solutions, on the other hand, concentrate the metal in the centre. The salts of silver, lead, and the per-salts of mercury when moderately concentrated give a wide water ring containing no metal; while the salts of copper, nickel, cobalt, and especially cadmium, must be much more dilute to present the same appearance. This property of cadmium to spread itself over the whole drop is so marked that it affords an elegant means of detecting Cd in the presence of metals whose sulphides are black. The diluted solution is dropped upon filter-paper, and the spot allowed to extend as far as possible. On exposure to SH_2 a black patch is formed surrounded by a vivid yellow ring. A solution containing much nickel, cobalt, or iron in presence of copper, &c., may be examined successively with SH_2 and SAm_2. The presence of free acid increases the mobility of copper salts considerably.

The next paper was read by M. M. P. Muir; it was entitled "*On Essential Oil of Sage*," by S. Siguira and M. M. P. Muir. The authors refer to a former paper on the same subject (*Phil. Mag.*, Nov., 1877). The sample of oil with which the present experiments were made had been recently distilled at Leipzig, and was obtained from Messrs. Wright, Layman, and Co. The oil consists mainly of two terpenes, an oxidised liquid, and a camphor. The properties of the terpenes and of salviol, as far as these have yet been examined, are as follows:—1. Terpene boils at 152° to 156°; sp. gr. at 15° 0·8435. Refractive index for D-line at 20° = 1·46071. Hence, specific refractive energy = 0·546; specific rotatory power for soda flame = +12·4. 2. Terpene boils at 162° to 167°; sp. gr. at 15° 0·8653; refractive index at 20° for D 1·4658; refractive energy 0·538; specific rotatory power for soda flame +13·4. Salviol boils at 197° to 203°; sp. gr. at 15° 0·934; refractive index for D at 20° 1·4623; refractive energy 0·495; specific rotatory power for soda flame +16·19. The terpene of lower boiling-point yielded acetic and carbonic acids on oxidation. The higher terpene yielded oxalic acid on oxidation with nitric acid. Salviol yielded oxalic acid, carbonic acid, and hydrocyanic acid on oxidation with nitric acid; a small quantity of what was almost certainly camphor was also produced on distilling the product of the action of nitric acid on salviol with water. The action of bromine upon salviol resulted in the formation of an unstable brominated compound and of small traces of camphor. Phosphorous pentoxide con-

verted salviol for the most part into cymene, but a small quantity of a terpene appeared also to be produced. A small quantity of absolutely pure sage oil has been examined by the authors. It consists for the most part of a terpene, boiling at 264° to 270° ($C_{15}H_{24}$); sp. gr. at 0° 0·9198; at 12°, 0·9137; at 24°, 0·9072; and at 41°, 0·8970. 100 m.m. rotated the polarised ray +3·14°. The terpene is of a dark emerald-green colour. The authors are continuing their investigation.

In the discussion which followed Dr. ARMSTRONG stated that he had obtained by the action of bichromate and sulphuric acid on the camphene from American oil a substance which was dextro-rotatory, and resembled ordinary camphor.

The next paper was read by the SECRETARY "*On the Action of Bromine upon Sulphur*," by J. B. HANNAY. On treating ordinary flowers of sulphur with bromine the author found that some of the sulphur remains undissolved; this insoluble residue was found to consist entirely of prismatic sulphur, and amounted to 0·08 per cent of the sulphur used. Carbon disulphide leaves about 0·12 per cent undissolved. Roll sulphur when treated with bromine dissolves completely. The author examined with a spectroscope the vapour overlying a mixture containing SBr; he found that even at 0° the vapour gave the characteristic spectrum of bromine vapour as mapped by Roscoe and Thorpe. If more sulphur were dissolved, however, the spectrum disappeared. Thus, with a layer of liquid 0·5 metre thick, the absorption spectrum ceased to be visible in a liquid containing S_3Br at +42°, S_5Br_2 at +33°, S_2Br at +25°, S_4Br_3 at +13°, SBr at +3°. The author finds that the liquid in large mass begins to boil at 72°, and rises without any pause, so that no evidence of the existence of a definite compound can be obtained by the boiling-points. On mixing bromine and sulphur in the requisite amount a rise of temperature of 20° was observed; some of this rise the author believes to be due to the change of state of the sulphur, because the amount of heat when plastic sulphur is used is distinctly less, only 12°. The author also estimated the sp. gr. of various compounds or mixtures:—S_3Br, 2·293; S_2Br, 2·625; SBr, 2·628; SBr_2, 2·820; SBr_3, 2·880; SBr_4, 2·905, but without obtaining any evidence of the existence of SBr. An examination of the freezing-points showed that the liquids became oily without solidifying, even at temperatures at which bromine is solid. The estimation of the vapour tension was also without avail. If a small quantity of arsenic be dissolved in the liquid SBr, and the mixture cooled to −18°, beautiful dark red crystals are obtained of the composition AsS_2Br_3, probably $AsSBr,SBr_2$. The author therefore concludes that the action of any quantity of bromine on any quantity of sulphur is an action on the whole mass and not in multiple proportion, but that if at low temperatures the compound SBr_2 meets a body with which it can form a molecular combination it assumes the crystalline form in conjunction with such a body. The action of bromine upon sulphur increases in a regular manner up to SBr_2, totally ignoring SBr; above SBr_2 we may have another curve to SBr_4, and another fainter curve to SBr8, but we have no evidence of the existence of S_2Br_2.

Mr. MUIR thought that there was some evidence of the existence of SBr. In his experiments there seemed to be a stop in the distillation at 200°; this was confirmed by passing CO_2 through a mixture for some time and examining the residue.

Mr. GROVES observed that the rise of temperature which occurred in mixing the two elements did not give the whole of the heat evolved, as some heat must be absorbed by the sulphur in passing from the solid to the liquid state.

The next paper was "*On the Determination of High Boiling-points*," by T. CARNELLY and W. C. WILLIAMS. The determination of the melting-points of a large number of metallic metals by Carnelly enabled the authors, in cases where only approximate results were required, to ascertain the boiling-point of a substance by observing whether or not certain salts fuse when exposed to the vapour of the substance in question when boiling. The metallic salts are contained in capillary tubes. Thus determined, S boils at 446° to 451° (Regnault gives 447°). Anthracene, 339° to 359°; HgI_2, 339° to 359°; AsI_3, 394° to 414°; $BiCl_3$, 427° to 439°; SbI_3, 414° to 427°; $ZnBr_2$, 695° to 699°; $ZnCl_2$, 708° to 719°; TlCl, 719° to 731°; TlI, 806° to 814°; Cd, 772°.

The last paper was "*On High Melting-points*," Part IV., by T. CARNELLY, D.Sc. (Lond.). The author has carefully investigated and got rid of two sources of error which existed previously in his method (*Chem. Soc. Journ.*, 489, 1876). He now uses a much finer platinum wire to suspend the crucible, and has re-determined the value of his calorimeter with very great care. In the present paper he gives the melting-points of over one hundred substances, and promises in a short time some interesting theoretical results, which he has deduced from the above observations; the most important being, that in simply binary compounds if one of the elements remains the same, then the melting-point is a periodic function of the atomic weight of the other. The author also hopes to be able to indicate a method by which many unknown melting-points may be predicted.

After the thanks of the meeting had been given to the authors for their respective papers the Society adjourned to June 6.

PHYSICAL SOCIETY.

May 11, 1878.

Prof. W. G. ADAMS, President, in the Chair.

THE following candidate was elected a Member of the Society:—Rev. P. Magnus, B.A., B.Sc.

Mr. J. NORMAN LOCKYER, F.R.S., read a paper on "*Some Recent Researches in Solar Chemistry*," a report of which is deferred until next week.

Sir WILLIAM THOMSON, LL.D., F.R.S., described and exhibited the apparatus he has employed in recent researches on the influence of stress on magnetisation, a detailed account of which he has just submitted to the Royal Society; he also, in part, described them at the Royal Institution on the 10th inst., but attention was not then directed to the experimental details now brought before the Society. The rod or wire under examination was surrounded by two coaxial wire helices, the outer of which was connected with the battery, and the inner with a ballistic galvanometer; that is, one that acts with regard to electric impulses just as Robins's ballistic pendulum. It was some years ago discovered by Villari that a longitudinal pull augments the temporary induced magnetism of soft iron bars, or wires, when the magnetising force is less than a certain critical value, and diminishes it when the magnetising force exceeds that value; in either case the residual magnetism is augmented when the force is applied, and diminished when it is removed. Sir W. Thomson has found the critical value for soft iron to be about 24 times the vertical component of the earth's magnetic force, or 10 G.C.S. units. In the case of some bars of nickel and cobalt, specially prepared for him by Mr. Wharton, of Philadelphia, he finds opposite effects, so that beyond the critical value pull *increases* the magnetisation. The next branch of the inquiry had reference to transverse stress, obtained by water pressure within a gun-barrel, and it was ascertained to have an opposite effect to that found by Villari, in the case of longitudinal pull; the critical point in soft iron for transverse pull, is at about 25 C.G.S. units. Sir W. Thomson has been examining the effect of torsion on a wire that is at the same time exposed to longitudinal pull, confining himself in his first set of experiments to magnetisation,

under the sole influence of the vertical component of terrestrial magnetism. His results showed, with every amount of longitudinal pull, a diminution of magnetisation produced by torsion in either direction, thus extending a conclusion arrived at by Matteucci, Wertheim, and Wiedemann, regarding the effect of torsion unaccompanied by longitudinal stress. But it now appears that this effect of torsion is very remarkably diminished by a large pulling force nearly reaching the limits of elasticity. In conclusion, Sir W. Thomson called attention to a very different and extremely interesting effect of torsion, discovered by Wiedemann—the development of longitudinal magnetisation in an iron wire by twisting it while a current of electricity is flowing along it. This effect, he pointed out, is just what would result from the œolotropic susceptibility for magnetisation due to the œolotropic stress produced in the outer portion of the wire by the torsion, supposing the tangential magnetising force to be less than a certain critical value, intermediate between the Villari critical value and the more than twofold greater critical value, which Sir William Thomson has found for transverse magnetising force. But he pointed out that another cause was also positively efficient in contributing to Wiedemann's result. This cause is the difference of electric conductivity in different directions, which may be inferred from Sir W. Thomson's early experiments, and from Mr. Tomlinson's recent confirmations and extensions of the conclusions to which he was led regarding the effect of stress on the electric conductivity of metals. It is much to be desired that Mr. Tomlinson should continue his experiments; but in the meantime it may be regarded as almost certain that the electric conductivity in the outer parts of an iron wire twisted within its limits of torsional elasticity is maximum and minimum in the two spirals at 45° to its length; being minimum in that one of them which is in the same direction as the twist, that is, the one corresponding to the maximum extension of the substance; and the conductivity is a maximum in the other 45° spiral, which is the direction of maximum contraction of the substance. The effect of this œolotropic conductivity, if it exists, must be to cause the electric currents to flow in spirals of opposite spirality to that of the twist, and to produce a corresponding amount of longitudinal magnetisation. The effect of this is to develope, at the end by which the current enters, a true North Pole when the twist is right-handed, and a true South Pole when left-handed, which is Wiedemann's result; but if the tangential magnetising force exceeds the critical value, the effect of the œolotropic magnetic susceptibility is opposite to Wiedemann's result; and if this result is still observed with such strong currents as to produce a magnetising force above the critical value, it must be due to excess of effect in one direction, due to œolotropic conductivity above the effect in the opposite direction, due to œolotropic susceptibility. This is a subject of great interest, and requires further investigation.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, March 5, 1878.

Dr. R. Angus Smith, F.R.S., &c., Vice-President in the Chair.

"*On the Decomposition of Ultramarine by Carbonic Acid*," by Mr. S. Suguira (Student in the Chemical Laboratory of the Owens College.) Communicated by Professor Roscoe, F.R.S., &c.

It has been proposed to employ ultramarine for the detection of free hydrochloric acid in presence of carbonic acid, on the ground that it is not acted upon by the latter, while the former easily attacks it.* In making some experiments in connection with this subject, I found, however, that carbonic acid itself decomposes ultramarine, as the following experiments will show.

A glass cylinder about a foot in height and an inch in diameter was filled with distilled water, and carbon dioxide evolved from sulphuric and sodium bicarbonate or hydrochloric acid and calcspar, was allowed to bubble up through the column of the liquid. In order to be perfectly sure of the purity of carbon dioxide gas, it was passed through a series of flasks containing distilled water, and then through a long tube containing solid sodium bicarbonate, to keep back any free acid which might be mechanically carried over.

After passing a steady current of the gas through for 15 minutes, the water in the cylinder was tested for acids other than carbonic. The absence of sulphuretted hydrogen was also proved by exposing a paper moistened with lead acetate solution.

Then about 0·07 grm. of ultramarine infused in 2 c.c. of distilled water were added to the water in the cylinder. Within 5 minutes the paper turned brown, showing the presence of sulphuretted hydrogen, which therefore can only be attributed to the decomposition of ultramarine.

In order, however, to ascertain the presence of any alkaline sulphide existing as such and not as a constituent of ultramarine, a large quantity of the latter was treated with distilled water and quickly filtered. The filtrate contained no sulphide. Hence the evolution of sulphuretted hydrogen was really due to the decomposition of ultramarine by the carbonic acid. The colour of the pigment was dulled, but could not be destroyed completely even when metallic chloride existed in the solution.

Through the kindness of Messrs. Jewsbury and Brown, I got a dozen bottles of aërated water, one half of which were charged with 2 grains of sodium chloride in each. The effects of these waters upon ultramarine were compared together week after week by putting 0·07 grm. of the pigment into the cylinder containing these liquids. In all cases the following effect was observed: the decomposition of ultramarine did not commence at once, but on standing for about an hour the paper moistened with lead acetate solution and placed over the cylinder began to be blackened. A few minutes afterwards the odour of sulphuretted hydrogen was distinctly observed. To prove the absence of sulphuretted hydrogen in laboratory air, a similar paper was placed over a jar containing the infusion of ultramarine in distilled water, which remained unchanged during the experiments.

These experiments, though qualitative, show that carbon dioxide in aqueous solution, viz., carbonic acid, can attack ultramarine, and therefore the latter is not a safe indicator of free hydrochloric acid in presence of carbonic if the former exist in very small quantity.

* H. Müller, *Chem. Soc. Jour.*, N.S., viii., 38.

Ordinary Meeting, April 2, 1877.

E. W. Binney, F.R.S., F.G.S., President, in the Chair.

"*On Aurin*," by R. S. Dale, B.A., and C. Schorlemmer, F.R.S.

In a paper read before this Society, on 31st October, 1871, we gave a short account of this colouring matter, which was discovered by Kolbe and Schmitt in 1861. We showed that the commercial product, which is called aurin or corallin, and is obtained by heating of phenol with sulphuric acid and oxalic acid, is a mixture of different bodies from which we isolated a colouring matter which crystallised exceedingly well and for which we retained the name of Aurin.* The analysis of this body gave numbers agreeing with the formula $C_{20}H_{14}O_3$, from which we concluded that it was produced by the action of nascent carbonic oxide on phenol:

$$3C_6H_6O + 2CO = C_{20}H_{14}O_3 + 2H_2O.$$

* A full account of this investigation is found in *Journ. Chem. Soc.* (2), xi., 434.)

We further showed that aurin, when treated in an alkaline or acid solution with zinc-dust, combines, like most other organic colouring matters, with hydrogen, yielding leucaurin, $C_{20}H_{16}O_3$, which readily crystallises in large colourless prisms, whilst on heating aurin with ammonia under pressure a new red colouring matter is formed, which is called red aurin or peonin.

The further investigation of this body showed that it contained nitrogen, which, on heating with soda-lime, was evolved in some cases completely as ammonia, while in others, where the action of the ammonia went on longer it was given off, at least partly, in the form of aniline. We then found, that on continuing the heating, the red colour of the liquid became paler, and at last a yellowish solution was obtained, from which water precipitated a white crystalline body, possessing all the characteristic properties of rosaniline.* The formation of this compound might be explained by the following equation:

$$C_{20}H_{14}O_3 + 3NH_3 = C_{20}H_{17}N_3 + 3H_2O.$$

But Hofmann, who has most carefully examined rosaniline as well as a great number of its derivatives, found that the formula of this base is $C_{20}H_{19}O_3$, and this result has been confirmed by Caro and Gräbe,† who showed that rosolic acid, which is obtained from rosaniline by a reaction, which shortly may be stated to be the inverse of that above given, has the composition $C_{20}H_{16}O_3$, while its properties are in almost all respects so similar to aurin, that some chemists, including ourselves, have been inclined to regard them as identical.

In order to clear up these points it was necessary to prepare a considerable quantity of pure aurin. We have already shown in our memoir read before the Chemical Society,‡ that a pure compound is readily obtained by heating pure phenol with oxalic and sulphuric acids for a few days to about 105° C. Although a good product is thus obtained, the yield is but small, while on heating the mixture longer or to a higher temperature by-products are formed. Some chemists have stated that the formation of the latter cannot be avoided, and that it is very difficult to obtain thus a pure aurin. We believe that we are able to explain these different results; the formation of a pure compound depends much on the proportions and the manner in which phenol and the acids are mixed. As however, the preparation of pure aurin by this method is a very tedious process, we endeavoured to obtain it from the commercial product by the method which we have described in our first paper, and purifying it by repeated re-crystallisation from alcohol, the crystals separating out first being used for further purification, because we found that the purer aurin is, the less soluble it becomes, its solubility being increased by the admixtures which are present in the crude product.

Another method for purification which we employed consisted in washing good commercial aurin with cold alcohol until only a comparatively small residue was left, which was then further treated as above stated.

The different crops of crystals were analysed, and the purification continued until the product did not change its composition any more. A great number of analyses were thus required, and we have great pleasure in expressing our best thanks to Mr. L. T. O'Shea, who performed them with great care.

The results did not, however, agree with our former; the product having a constant composition, and crystallising exceedingly well, gave numbers agreeing with the formula $C_{19}H_{14}O_3$. We therefore again prepared aurin from pure phenol, and crystallised it repeatedly from alcohol, until its composition became constant. and found it to have the same formula.

Aurin, therefore, appears to be the lower homologue of rosolic acid; like the latter, it readily forms a tetrabromo-compound, which we obtained pure by the following process. Pure aurin was dissolved in hot glacial acetic acid, and this solution poured into a mixture of an excess of bromine and acetic acid. The liquid remained perfectly clear, but on standing for a few days the tetrabromaurin crystallised out almost completely. It forms small brownish green crystals, with a metallic lustre, which dissolve in alkalies with a purple colour. The determination of the bromine gave numbers agreeing closely with those required for the formula $C_{19}H_{10}Br_4O_3$.

Whilst this investigation was going on a new light was thrown on the subject by the researches of E. and O. Fischer. In order to elucidate the constitution of rosaniline these chemists endeavoured to convert rosaniline into the hydrocarbon from which it is derived. In this they did not succeed, but they were able to transform leucaniline, $C_{20}H_{21}N_3$, which stands to rosaniline in the same relation as leucaurin to aurin, into a hydrocarbon, $C_{20}H_{18}$, which is the mother substance of this base, and from which it follows that the hydrocarbon corresponding to rosaniline has the composition $C_{20}H_{16}$, which also confirms the correctness of Hofmann's formula for rosaniline. The leucaniline, which they employed was obtained from commercial rosaniline; but Rosenstiehl has shown that this body, which is prepared by oxidising a mixture of aniline, solid paratoluidine, and liquid pseudotoluidine, contains several, probably isomeric, bases. E. and O. Fischer therefore, in continuing their research* prepared one of them in the pure state by using a mixture of pure aniline and pure paratoluidine. The product was converted into the leuco-compound, from which, to their surprise, they obtained, not as before, the hydrocarbon $C_{20}H_{18}$, but one having the composition $C_{19}H_{16}$, or the lower homologue of the former. They found the new hydrocarbon to be identical with one already known, which was discovered by Kekulé and Franchimont, and called Triphenyl-methane, $CH(C_6H_5)_3$, as it is a marsh-gas or methane, in which three atoms of hydrogen are replaced by three phenyl-groups. Hemilian, who afterwards obtained the same hydrocarbon by a different method, examined it more fully, and found amongst other results that concentrated nitric acid converts it into the tri-nitro-compound $C_{19}H_{13}(NO_2)_3$; E. and O. Fischer prepared the same body, which, by the action of nascent hydrogen was converted into a base, having all the characteristic properties of leucaniline. This was heated with arsenic acid, in order to abstract hydrogen by oxidation, and the rosaniline which formed the starting point of their last investigation was obtained again.

From these results it follows that commercial rosaniline consists principally of the base $C_{20}H_{19}N_3$, and is probably a derivative of pseudotoluidine, while the rosaniline from paratoluidine, and which has therefore been called para-rosaniline, is its lower hololague, having the formula $C_{19}H_{17}N_3$. The rosaniline which we obtained from aurin is undoubtedly identical with the latter,† its formation being readily explained by the following equation:—

$$C_{19}H_{14}O_3 + 3NH_3 = C_{19}H_{17}N_3 + 3H_2O.$$

The question which now has to be solved is how to explain the formation of aurin; we have already made experiments in this direction and obtained interesting results, which, however, are not yet sufficiently worked out to publish them.

Another question to be elucidated is, what is the chemical constitution of aurin? According to E. and O. Fischer that of pararosaniline is $C_{14}H_{11}(NH_2)$, from which it follows that aurin is $C_{14}H_{11}(OH)_3$. Already, in our first research, we obtained results which seem to confirm this view. On heating aurin with acetyl chloride, we obtained a colourless crystalline compound, which, on analysis, gave results nearly agreeing with the composition of triacetyl aurin, $C_{19}H_{11}(OC_2H_3O)_3$, and on using benzoyl

* *Journ. Chem. Soc.* (2) xi, 434.
† *Liebig's Ann.* clxxix, 148.
‡ *Journ. Chem. Soc.* 1877, ii., 121.

* *Ber. Deutsch. Chem. Ges.*, xi., 195.
† Since this was written, E. and O. Fischer prepared some pure aurin according to our directions, and converted it into a leucorosaniline, from which they also obtained triphenylmethane (*Deutsch Chem. Ges. Ber.*, xi., 473).

chloride a similar benzol-compound was obtained. The analytical numbers did not, however, sufficiently agree with those required by theory, and therefore we did not publish them; and, as the purification of these compounds was found to be beset with several difficulties, we did not then examine them further, because we believed the study of red aurin would more readily throw light on the subject. We have now prepared them again from pure aurin, and hope to be soon able to settle these points.

"*The Origin of some Ores of Copper.*" Part II. By Charles A. Burghardt., Ph.D., the Owens College.

Atacamite.—This interesting and beautiful mineral occurs generally in radiating foliated masses, or in bundles of acicular crystals, which are characterised by a fine vertical striation upon their vertical faces. Globular, reniform, and stalactitic atacamite is also known. Thus it is safe to infer that in a great majority of cases the mineral has been formed in some way from a solution of copper salt, and not by ingenious action. It is also a well known fact that atacamite crusts are occasionally found resting upon clefts in the lava of some volcanoes, being formed by the action of hydrochloric acid gas evolved by the volcano upon copper, or a compound of that metal, but these crusts are insignificant in quality, and comparatively scarce. In Chili, Bolivia, and the West Coast of Africa, very large quantities of atacamite are obtained as a commercial product; it therefore becomes interesting to the mineralogist to ascertain under what conditions these formations arose, and in order to do this a thorough chemical examination of the mineral itself is necessary. Atacamite is known to occur in nature in three states of hydration, and as an example of the first I may mention a specimen from Algodon Bay, Bolivia, analysed by Bibra (*Jahresbericht*, 1858, 740), which had the following composition, viz.:—

Cu	59·25 per cent.
Cl	16·11 ,,
O	12·51 ,,
H_2O	12·13 ,,
	100·00

The formula corresponding with the above analysis being $Cu_4O_3Cl_2+3H_2O$. The atacamite of Copiapo, Chili, as analysed by Field (*Journ. Chem Soc.*, (7), 3, 193) has the following composition, viz.:—

Cu	56·38 per cent.
Cl	14·95 ,,
O	10·78 ,,
H_2O	17·89 ,,
	100·00

The formula for this being

$$Cu_8O_6Cl_4+9H_2O, \text{ or } (Cu_4O_3Cl_2)_2+9H_2O.$$

The third state of hydration is represented in the atacamite from Botallack, Cornwall, analysed by Church (*Journ. Chem. Soc.*, (2), 3, 212), and that from Tocopilla, near Cobija, Bolivia, analysed by Berthier (*Ann. des Mines*, (3), 7, 542), the composition being as follows:—

Botallack Atacamite.		Tocopilla Atacamite.	
Cu	52·90	Cu	53·26
Cl	14·76	Cl	14·92
O	10·49	O	9·37
H_2O	22·45	H_2O	22·45
	100·00		100·00

and the formula $Cu_4O_3Cl_2+6H_2O$.

Having given a general idea of the composition of the various atacamites, I will now point out how some of them can be prepared artificially. Field (*Phil. Mag.*, (4), xxiv., 1862, 124) prepared the last-mentioned variety by adding a solution of calcium hypochlorite to an excess of cupric sulphate, and boiling the mixture for some time, when an apple-green precipitate was observed, which proved on analysis to be identical with Berthier's atacamite from Cobija. If the ebullition were not sufficiently kept up, the compound was found to contain only 4 atoms of water. Proust prepared a green compound (which no doubt was atacamite, although its exact composition is not given) by exposing moist cuprous chloride to the air, also by digesting a solution of cupric chloride with cupric oxide. In a former communication to this Society (*Proc. Lit. Phil. Soc.*, xvii., 1877-78, 27—36) I mentioned that on heating some crystals of cuprous chloride in water in a sealed tube at a temperature ranging from 160°—180° C°, that minute green spots of a substance resembling atacamite were observed upon the sides of the tube. Further on, heating cuprous oxide and a strong solution of chloride of sodium together in a sealed tube, at 150°—180° chalcotrichite was formed, and also a green substance resembling atacamite. Wishing to ascertain whether atacamite could be prepared in larger quantity (in accordance with my supposition that all the copper ores are products of the decomposition of cuprous oxide, the latter substance being a secondary product of the oxidation of the metal itself), I made numerous experiments, mostly consisting in the heating of cuprous oxide with sodium chloride solution in sealed tubes, and obtained excellent results, by simply covering a quantity of cuprous oxide with a concentrated solution of sodium chloride, exposing this mixture to the air at the ordinary temperature, and stirring it up occasionally. By proceeding in this way a very concentrated solution of cuprous chloride in sodium chloride can be obtained. After standing a few days this solution begins to decompose, a green insoluble substance separating out continually, which can easily be filtered off from the liquid portion and well washed in cold distilled water, in order to free it from all traces of cuprous chloride and sodium chloride. The substance thus obtained was carefully dried over calcium chloride until its weight was constant, and portions weighed out and analysed quantitatively with the following result, viz:—

Cu	56·25 per cent.
Cl	14·29 ,,
O	10·95 ,,
H_2O	18·51 ,,
	100·00

It will readily be seen that the above analysis agrees very closely with one made by Field already referred to; whence it follows that the substance prepared by myself is identical in composition with the atacamite of Copiapo, Chili. The *rationale* of the formation is briefly this—"The cuprous chloride held in solution by the sodium chloride takes up oxygen from the air very rapidly, giving rise to the formation of cupric oxychloride and cupric chloride (the latter soluble in water), both eventually becoming hydrated." The following equation expresses the first stage of the reaction, viz:—

$$3Cu_2Cl_2+O_3=CuCl_23CuO+2CuCl_2.$$

Nearly all specimens of atacamite are intimately associated with cuprite, so that it appears highly probable that the former mineral has been obtained from the latter in the manner stated, more especially as atacamite is found in veins of other copper ores, associated with quartz, chalcedony, &c., in diorite and syenite. Again, at Sierra do Lembe, near Ambriz, on the West Coast of Africa, there is a large occurrence of atacamite in the malachite deposits, the "gangue mineral" being quartz. Debray (*Zeitsch. f. Chem.*, 1867, 276) prepared crystallised atacamite by heating together basic cupric nitrate and a concentrated sodium chloride solution for several hours at 200° C., also by heating copper ammonium sulphate with a strong sodium chloride solution at 100° C. Up to the present time I have not succeeded in preparing the mineral in a crystalline state. A curious fact I may mention, viz., that natural cupric oxychloride should increase in hydration by three atoms of water.

EDINBURGH UNIVERSITY CHEMICAL SOCIETY.

Ninth Meeting, May 15, 1878.

John Gibson, Ph.D., F.R.S.E., in the Chair.

A paper was read by W. Inglis Clark, D.Sc., "*On the Gallate and Tannate of Iron*," in which he reviewed the work of previous experimenters, and then detailed the results which he had himself obtained in a very extensive experimental investigation into the nature and properties of these substances, and the modifications they undergo when exposed to the action of acids, sugar, and other bodies. A series of curves, embodying the results of these experiments, were exhibited, and showed clearly the interesting deductions which the author was able to make from them. It was further shown that by the action of aqueous gallic acid on metallic iron a black compound was obtained, which, when heated to 120° C., gave a percentage of iron corresponding to the formula $FeC_7H_3O_5$, while before heating it corresponded to the salt—

$$FeC_7H_3O_52H_2O.$$

Two combustions, closely agreeing, gave a deficiency of carbon of about 4 per cent; thus opposing the view that the body under question was ferric gallate. The author is further investigating the matter.

DUBLIN UNIVERSITY EXPERIMENTAL SCIENCE ASSOCIATION.

A General Meeting of the above Association was held in the Museum Buildings (New Square), Trinity College, on Wednesday, May 8th, 1878.

Communications.—G. F. Fitzgerald, F.T.C.D.—On Surface Tension, and its Possible Relation to Muscular Contractions. Professor Reynolds, M.D.—Note on Specimens of "Maltose," or Malt Sugar. Edward G. Hull.—An Algebraic Proof of Wheatstone's Bridge. Denis M'C. Mahony, B.A.—Note on the Dibasicity of Carbonic Acid.

Exhibitions.—Professor Reynolds, M.D.—A Large Specimen of Tetrabromide of Silicon; Large Specimens of Tetrachloride of Silicon. Edward G. Hull.—A Simple Current Reverser.

CORRESPONDENCE.

NITRIC ACID IN THE VITRIOL MANUFACTURE.

To the Editor of the Chemical News.

Sir,—The letter which appeared in your issue of the 10th inst. from Mr. Davis, headed "Nitre Losses in the Vitriol Manufacture," is one which it would be a mistake to allow to pass unnoticed. It is really too much to expect that your readers are to be treated in the manner in which Mr. Davis has done in connection with the subject of the loss of nitre. He makes the most distinct assertion (*vide* Chemical News, vol. xxxvii., p. 117)—which with other of his statements has been copied in the United States and elsewhere—that the loss of nitre is caused by the reaction of the N_2O_3 on the As_2O_3 in the acid run down the absorber; and now it seems as if he imagined that your readers are to rest satisfied with his recent letter and explanation that "I have pointed out that the loss of N_2O_3 is *nearly equal* to the amount which *would* be decomposed by the arsenic run down the absorbing tower—*a strange coincidence*" (the italics are mine). Surely, Sir, we have a right to expect from one who undertakes—with such a preliminary flourish of trumpets—to enlighten us on such a subject more than a mere statement of a strange coincidence. I do not wish it to be inferred that I think Mr. Davis's work altogether to be condemned; far from it. What I object to is his drawing conclusions in such a rash way from what were in themselves no doubt perfectly good experiments in so far as they go.

In his last letter the statement is made that "I consider to have proved that in the vitriol manufacture, working *without towers*, the whole of the nitre can be accounted for as in the instances A, B, C, and D given." I consider that he has done nothing of the kind. Take these cases, and we have, in A, 4 testings = 4 cubic feet taken from 5,491,463 cubic feet passing per week with variations in the tests from 1·8 to 2·6, or say 100 to 144.

Case B.—4 testings = 4 cubic feet taken from 8,567,200 cubic feet passing per week, with variations in the tests from 0·72 to 3·57, or as near as possible 100 to 500.

No attention seems to have been paid to the stock of acid in process, and its variations in percentage of nitrous compounds, a very material element in such a calculation.

Cases C and D having been "only occasionally watched," there being only two tests of each, it would be an utter waste of time to discuss such figures.—I am, &c.,

James Mactear.

St. Rollox, Glasgow, May 14, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 15, April 15, 1878.

Action of Oxygen upon Acid Chlorides and Analogous Compounds of Tin, Silicium, and Boron.—M. Berthelot.—From the author's observations it results that the provisions of electro-chemical theory are confirmed on a detailed study of the reciprocal displacements between oxygen, chlorine, bromine, and iodine, both with the metals and non-metals.

New Compound of Palladium.—H. Sainte-Claire Deville and H. Debray.—On heating a solution of palladium chloride, PdCl, with strong nitric acid in presence of sal-ammoniac the palladium is converted into an ammonia-chloride, $PdCl_2+NH_4Cl$, which precipitates in small regular octahedra of a fine red colour, sparingly soluble in water, and like the corresponding compounds of iridium and platinum, almost insoluble in a concentrated solution of sal-ammoniac. The authors thought that on treating with aqua regia certain mother-liquors containing ammoniacal palladium chloride (dipalladamine chloride, $PdCl,2NH_3$) with excess of ammonium chloride the metal would be entirely thrown down as a double chloride—an expectation not fulfilled. Instead of the desired compound they obtained a reddish black substance $Pd_2Cl_3,2NH_3$, the result of the combination of ammonia with a palladium chloride hitherto unknown.

Equivalent of Gallium.—Lecoq de Boisbaudran.—The existence of several chlorides of gallium has prevented the author from determining its equivalent by weighing the chloride or bromide of silver without having previously ascertained the conditions under which these salts are obtained in a state of purity. He has determined the equivalent by the calcination of gallo-ammoniacal alum, and by igniting the gallium nitrate produced from a known weight of the metal. The slight losses sustained in these two operations affect the value of the equivalent in an opposite manner. The former process gave as the result 70·032 (H=1), and the latter 69·698. The mean value, 69·865, may be taken as the first approximation. Considerations founded upon a classification of the ele-

ments in accordance with their properties and the value of their atomic weights point to a maximum number, 69·97, and a minimum, 69·66 (mean 69·82). The author enters into some details on the comparison of the spectra of the metals Al, Ga, In, on the one hand, and K, Rb, Cs, on the other, and deduces, hence, for the equivalent of gallium the value 69·86.

Theory of the Propagation of Electricity in Conductors.—M. Mascart.—A mathematical paper not adapted for abstraction.

Heat of Formation of Metallic Chlorides United with Ammonia.—M. Isambert.—Zinc chloride at a moderate temperature is capable of partially decomposing ammonium hydrochlorate and expelling the hydrochloric acid. At first sight this effect might be assimilated to the reaction of a fixed acid which liberates one more volatile; but the phenomena of equilibrium which preside at this deplacement show a connection at once with the principle of a thermic maximum and with dissociation.

Dissociation of Chloral Hydrate.—MM. Moitessier and R. Engel.— The authors contend that the vapour of boiling chloral hydrate is dissociated.

Isomerism of the Amylens.—A. Wischnegradsky.—The author considers that M. Etard's amylen is not isopropylethylen, but trimethylethylen.

Revue Universelle des Mines, de la Metallurgie, &c., Tome 3, No. 1, Jan. and Feb., 1878.

This issue contains no original chemical matter.

Les Mondes, Revue Hebdomadaire des Sciences, No. 15, 1878.

This issue contains nothing of general interest.

NOTES AND QUERIES.

Chloride of Zinc.—Can anyone kindly state if chloride of zinc is a refuse product in any manufacture, and if it can be had cheap? also the nature and composition of Peacock's composition for painting ships' bottoms, and if patented?—C. H. A.

MEETINGS FOR THE WEEK.

SATURDAY, 25th.—Physical, 3. "On Brass Wind Instruments as Resonators," Mr. J. N. Blackley.
MONDAY, 27th.—Royal Geographical, 1 (Anniversary).
TUESDAY, 28th.—Civil Engineers, 8.
—— Royal Institution, 3. "On Some Points in Vegetable Morphology," W. T. Thiselton Dyer, M.A.
—— Anthropological Institute, 8.
WEDNESDAY, 29th.—Society of Arts, 8.
THURSDAY, 30th.—Royal Institution, 3. "On Molecular Physics: Gases," Prof. Guthrie.
FRIDAY, 31st.—Royal Institution, 8, Weekly Meeting. "The Native Races of the Pacific Ocean," Prof. Flower, 9.
SATURDAY, June 1st.—Royal Institution, 3. "On Richard Steele," (Additional Lecture), Prof. Henry Morley.

Lately published, in one vol. of 1091 pages, with Diagrams and other Illustrations. 8vo. £1 11s. 6d.

EXPERIMENTAL RESEARCHES IN PURE, APPLIED, AND PHYSICAL CHEMISTRY.

By E. FRANKLAND, Ph.D. (Marburg), D.C.L., F.R.S., Professor of Chemistry in the Royal School of Mines, &c.

The work includes investigations on the Manufacture and Illuminating Power of Gas, on the Water Supply of Towns, and the Purification of Drainage from Towns and Manufactories.

Also by Professor FRANKLAND,

LECTURE NOTES FOR CHEMICAL STUDENTS. Second Edition. Vol. I. (Inorganic), 4s. Vol. II. (Organic), 5s.

London: J. VAN VOORST 1, Paternoster Row.

PATENTS.—Mr. Vaughan, F.C.S., British Foreign, and Colonial PATENT AGENT. Special attention given to Inventions relating to Chemistry, Mining, and Metallurgy. "Guide to Inventors" Free by Post.—Offices, 67, Chancery Lane London, W.C., and 8, Houndgate, Darlington

ROYAL INSTITUTION OF GREAT BRITAIN, ALBEMARLE STREET, PICCADILLY, W.

PROFESSOR FREDERICK GUTHRIE, F.R.S., will, on THURSDAY NEXT, May 30, at Three o'clock, begin a Course of Three Lectures "ON STUDIES IN MOLECULAR PHYSICS: GASES, LIQUIDS, SOLIDS."

Subscription to this Course, Half-a-Guinea; to all the Courses, Two Guineas.

UNIVERSITY OF LONDON.

NOTICE IS HEREBY GIVEN, That the next Half-yearly Examination for MATRICULATION in this University will commence on MONDAY, the 24th of June, 1878. In addition to the Metropolitan Examination, Provincial Examinations will be held at Owens College, Manchester; Queen's College, Liverpool; Queen's College, Birmingham; St. Cuthbert's College, Ushaw; Stonyhurst College; St. Patrick's College, Carlow; St. Stanislaus College, Tullamore; and University College, Bristol.

Every Candidate is required to transmit his Certificate of Age to the Registrar (University of London, Burlington Gardens, London, W.) at least Fourteen Days before the commencement of the Examination.

WILLIAM B. CARPENTER, M.D., Registrar.

May 21st, 1878.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 22, Albemarle Street, W.—The NEXT ANNUAL GENERAL MEETING will be held at DUBLIN, commencing on WEDNESDAY, August 14.

President-Elect.

W. SPOTTISWOODE, Esq., LL.D., F.R.S., F.R.A.S., F.R.G.S.

NOTICE to CONTRIBUTORS of MEMOIRS.—Authors are reminded that, under an arrangement dating from 1871, the acceptance of Memoirs, and the days on which they are to be read, are now, as far as possible, determined by Organising Committees for the several Sections before the beginning of the Meeting. It has therefore become necessary, in order to give an opportunity to the Committee of doing justice to the several Communications, that each Author should prepare an Abstract of his Memoir, of a length suitable for insertion in the published Transactions of the Association, and that he should send it, together with the original Memoir, by book-post, on or before August 1, addressed thus:—"General Secretaries, British Association, 22, Albemarle Street, London, W. For Section ....." If it should be inconvenient to the Author that his Paper should be read on any particular day, he is requested to send information thereof to the Secretaries in a separate note.

G. GRIFFITH, M.A.,
Assistant-General Secretary, Harrow.

PROFESSOR HUGHES'S MICROPHONE.

Six Daniell Cells and Materials for Constructing Microphone for 21s.; carriage paid to any part of England. Telephones fixed or exhibited. Electric Bells, and all descriptions of Electrical Apparatus for Telegraph and for Experimental Purposes.—Edward Paterson, Electrical Engineer, 3, Bedford Court, Covent Garden, W.C.

ROYAL POLYTECHNIC.—THE SIEGE OF TROY has been reproduced, with new Scenery and Effects; rendered by Mr. Lin Rayne, supported by an efficient Staff.—THE CHEMISTRY OF THE SUN, by Prof. Pepper.—CLAY AND THE POTTER, by Prof. Gardner.—MODERN GUNS AND PROJECTILES, by Mr. J. L. King.—CLEOPATRA'S NEEDLE by Mr. W. R. May.—BULGARIA, by Mr. E. Wilkie.—Dr. SAMUEL JOHNSON AND HIS FRIENDS, by Dr. Aveling.—THE TELEPHONE, THE OXY-HYDROGEN MICROSCOPE, and TORPEDOES, by Mr. King.—HAYLING ISLAND, WHERE IT IS AND ALL ABOUT IT, by Mr. J. L. King.—Admission to the whole, 1s.; Schools and Children under Ten, 6d. Reserved Stalls (including Admission), 2s. 6d. Open at 12 and 7; Carriages at 5 and 10

A Gentleman with Capital wishes to meet with a Mechanic who has a practical knowledge of, or idea for, the manufacture of any article which would be of general consumption, and which might be made a monopoly.—Address, S. B. 68, Deacon's, 154, Leadenhall Street, London, E.C.

The Advertiser desires a Situation as Assistant to a Chemist in a Works or College. Has studied at the Royal College of Chemistry, and has had considerable experience in teaching, general analysis, and demonstrating. Good references.—Apply, A.B.C., care of W. Tweedie and Co., 337, Strand, London.

CENTRIFUGAL MACHINES (pair), 30 in.; just new, with pulleys and gear. Complete, except belting, £50.—Thames Chemical Works, Wandsworth

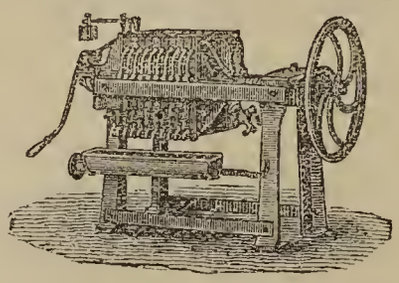
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

The speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction to Suit Special Requirements.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

CHEMICAL & PHYSICAL APPARATUS,

PURE CHEMICALS, BOTTLES, &c.,

For Manufacturers, Schools, Private Students, &c.

Price Lists Free. Carriage allowed to any Railway Station in England or Wales upon Orders of 40*s.* and upwards in value.

MOTTERSHEAD & CO.,
LABORATORY FURNISHERS,
7, Exchange Street and 10, Half Moon Street,
MANCHESTER

PURE ACIDS AND CHEMICALS FOR ANALYSIS.

KNOWLES & PHILLIPS,

47, MINORIES, E.C.

Price List forwarded on application.

N.B. References as to quality and price kindly allowed by several leading Analysts already supplied.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing rare Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for tudents, Schools, Colleges, &c.
NEW PATTERNS OF GEOLOGICAL HAMMERS.
NEW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
88, CHARLOTTE STREET, FITZROY SQUARE

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester

SPECIALITIES.

MANGANESE	Lump, Crystallised, Ground, and Prepa ed Large stock of every description. *** *Suitable for all Trades.*
ARSENIC	Refined powdered, Lump, Grey, and Ruby.
FLUOR-SPAR	Finest produced. Medium and Common for al purposes.
BARYTES	Carbonate and Sulphate. All qualities of Lump and Ground.
BAUXITE	Of high percentage of Alumina and low in Iron:

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

NOTE.—Special attention is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove and the cleanliness of application makes this one of the marvels o household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal P ly-technic Institution.

THE CHEMICAL NEWS.

Vol. XXXVII. No. 966.

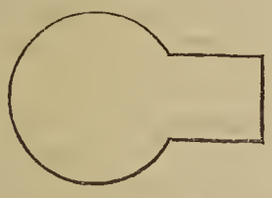
HOFMANN'S METHOD FOR THE DETERMINATION OF VAPOUR DENSITIES.

By WILLIAM A. TILDEN.

The great advantages of this method have led to its very general adoption by chemists, not on the score of special accuracy, which it does not possess, but because it affords a rapid process whereby approximate results are easily obtained applicable to the determination of molecular weights. The original process has been slightly modified in detail and simplified by Hofmann himself (*Deut. Chem. Ges. Ber.*, ix., 1304), by Wichelhaus (*Ber.*, iii., 166), by Brühl (*Ber.*, ix., 1368), and by Muir (*Journ. Chem. Soc.*, 1877, ii., 140).

The following is a description of the apparatus and process I have been using for some time. It costs little and is very easily managed, and gives good results. Its principal features are these:—The trough is of wood, the plate upon which the tubes rest is fixed, no special condenser for recovering the vapour of the aniline is necessary, and the volume occupied by the vapour of the substance is determined, not by weighing mercury, but by the far easier, and for this purpose equally accurate, plan of measuring an equal bulk of water.

The trough is cut out of a solid block of sycamore wood, 200 m.m. long, 120 m.m. wide, and 85 m.m. deep. It is excavated into a circular well, about 80 m.m. in diameter, and 56 m.m. deep, with a trough of the same depth extending from it 50 m.m. towards one end of the block. The cavity, when seen from above, has this shape—



A groove is cut longitudinally at the bottom sufficiently deep to allow a piece of glass tubing, about 6 m.m. in diameter, to lie in it. One end of the groove is continued into a cylindrical hole, which passes quite through the side of the well.

In this groove are placed two short pieces of glass tubing—each bent in the middle to a right angle, and so disposed that one end of each stands up vertically near the middle of the well. One of these is attached below to a piece of stout india-rubber pipe, which passes through the hole in the side and fits tightly into it. A thick and firm sheet of india-rubber is cut to the same size as the well, and has two holes bored in it, through which the upright portions of the glass tubes project. This sheet of india-rubber is glued to the bottom of the well. It is not absolutely necessary, but it affords a bed upon which the barometer and jacket may safely stand, and it also serves to protect the tubes below from injury.

The use of the two tubes is obvious. The one which opens into the groove below is cut off just above the surface of the caoutchouc plate. Over the open end of this the barometer is inverted, the tube serving to keep up free communication with the mercury outside. The office of the other tube is to convey away the steam or vapour of aniline employed as the source of heat. This tube stands up 35 m.m. above the surface of the caoutchouc plate. When the trough is to be used mercury is poured into it till the end of the short tube is submerged, whilst the mouth of the tube, which is to convey away the excess of vapour and condensed liquid, must of course remain uncovered.

The barometer tube is not graduated, neither is it necessary that it should be of perfectly uniform bore. To keep it upright a flat piece of cork is fastened at right angles to the upper part of the tube, and of such size as very readily to slide in and out of the external wider tube or jacket.

The mantle or jacket is a wide glass tube, ground flat at each end. It is a metre long, 50 m.m. in external diameter, and somewhat less than 2 m.m. thick. The upper end is fitted with a good cork (india-rubber stoppers cannot be used), through which passes the tube which conveys the steam or other vapour from the boiler. A thermometer also passes through this cork, and a short piece of glass tube having a stopcock, or closed by a piece of india-rubber tube with a clip. This stopcock enables the operator to regulate the pressure inside the jacket, when from irregular ebullition or condensation of the vapour there might be a risk of the mercury inside being drawn up to the mouth of the exit tube. By allowing the lower end of the jacket to stand in the mercurial trough the whole of the barometer is surrounded by vapour, and it is heated throughout to practically the same temperature. The upper part of the jacket should be enveloped in flannel.

For a condenser a straight piece of glass tube is attached to the india-rubber tube projecting from the side of the trough, which is placed at the edge of the table. The condensed liquid, and ultimately the vapour, is thus conveyed into a Winchester quart bottle containing a little water and standing upon the ground. When aniline is used condensation and recovery of the whole of the vapourised liquid is ensured in this way, and the water can afterwards be drawn off by means of a syphon. The presence of a little water in the aniline is no disadvantage, but is, on the contrary, of use, inasmuch as it effects the heating of the jacket and barometer more gradually than when dry aniline is employed.

After the introduction of the substance and its conversion into vapour, when the mercury in the tube has become stationary, the level of the upper surface of the meniscus is read off by the pendulum cathetometer, which must not afterwards be disturbed. The tubes are allowed to cool, the mantle carefully removed, and the barometer fixed upright by a clamp. A strip of gummed paper is then, as recommended by Hofmann, attached to the tube so that its edge is exactly on a level with the wires of the cathetometer. The barometer tube is then emptied, and to ascertain the volume the vapour had occupied it is only necessary to allow water to flow into it with all the usual precaution, from a burette till the lower surface of the curve corresponds with the edge of the paper. In this measurement the alteration in the capacity of the tube by reason of difference of temperature is left out of account. But this is compensated closely enough by the presence of the little bottle and its stopper, both of which occupy space that is reckoned as vapour. These corrections, therefore, cancel each other and may be disregarded. At the temperature of boiling-water the tension of mercury vapour is insignificant. But when aniline vapour is used it must not be neglected. Regnault's table gives the tension for intervals of 20°. The following are the values for every 5° between 180° and 200° obtained by interpolation from his numbers:—

185°	13·0 m.m.
190°	15·0 m.m.
195°	17·5 m.m.

It only remains to be added that the apparatus is very suitable for lecture demonstration. I have on several occasions exhibited the process to my classes. Having weighed the substance before the lecture, the whole operation of determining the vapour density of chloroform in steam occupied less than one hour; and this included the working out of the calculations on the black-board.

A PROCESS FOR COATING IRON WITH MAGNETIC OXIDE BY THE ACTION OF HEATED AIR.

By GEORGE R. TWEEDIE.

This process (invented by Mr. G. Bower, of St. Neots) is of a peculiarly interesting character, and a few words concerning it will not be out of place in this journal.

The idea of the process is, of course, to coat the iron with a film of magnetic or ferroso-ferric oxide (Fe_3O_4), and in this way protect it from ordinary oxidising influences. The details of the process are of the simplest possible character. The articles to be treated are placed in a chamber of fire-clay or iron capable of being raised to a red heat. This chamber is fitted with two pipes closed by cocks, one of which is to serve as an inlet and the other as an outlet for the air. The articles in the chamber having been raised to a sufficiently high temperature (ranging between 1600° and 1900° F.), air is passed in, and the inlet and outlet pipes closed for one hour, when they are again opened, and sufficient air sent in to drive out the whole of that deoxidised, the chamber being again closed. This renewing of the air is carried on until a sufficient thickness of the magnetic oxide is formed.

The magnetic oxide produced in this way has a beautiful light grey or neutral tint of a most delicate appearance, which most perfectly protects the iron from rusting under any ordinary conditions.

One experiment that was tried in the course of the investigation merits some attention. A square cast-iron bar was placed in the main duct of the hot-blast supplying the furnaces of Messrs. Cochrane, of Dudley. After six hours it was withdrawn, and found to be perfectly coated with the magnetic oxide; and the coating, although subjected to the severest possible tests for the past nine months, has completely protected the iron from rust.

An extended and laborious series of experiments has been carried out in connection with the process, and in many cases results have been obtained which possess features of peculiar interest to chemists, and I hope shortly to be able to publish in this paper some of the more important of them.

SOME REMARKS ON THE PREPARATION OF STEEL PLATES FROM BESSEMER INGOTS.

By SERGIUS KERN, M.E., St. Petersburg.

The author must premise that much in this article may not be new for managers of steel works, but certain remarks on steel plate rolling may be of use to persons who have had only a small practice regarding the manufacture of plates from Bessemer steel.

At present, steel plates are used in enormous quantities, and certainly for most purposes iron will be replaced by the cheap steels, viz., Bessemer and Siemens-Martin metals. Steel plates for shipbuilding, boilers, &c., are constantly prepared by steel works, and a special report on steel for shipbuilding, issued by the inspectors of Lloyd's, clearly shows that certain English works yield steel plates of a superior quality, which may be stated to be the best in the trade. The Bolton Steel Works for instance, in preparing plates, use superior raw materials, as may be seen by considering the following analyses of thin plates of their manufacture:—

	per cent. I.	II.
Combined carbon	0·07	0·08
Silicon	traces	traces
Phosphorus	0·05	0·04
Manganese	0·19	0·16

In preparing steel plates, good and clean raw materials are especially wanted. But even having steel of good quality, as to its chemical composition, the influence of certain surface defects of the ingots, and the mode of working the steel, have such a great influence on the steel rolling, that often good steel gives smooth plates, the surface of which are full of small excavations and flaws.

Most of the ingots from Bessemer steel are full of blow-holes in the interior, and several of the ingots have surface blow-holes, which always have a connection with the interior blow-holes. The air and the moisture enter, by means of these holes, into the ingot, and oxidise the surface of the blow-holes in a few days. This may be easily seen by breaking such an ingot under a steam-hammer. Certainly such ingots when rolled will give plates with interior flaws, arising from the contraction of the blow-holes. The surface blow-holes produce a very strange phenomenon:—A plate in hot state nearly always looks satisfactory, but just as it is cooled and slightly touched by a hand-hammer, in different places from its surface jump out small round pieces of the metal, which give rise to excavations. This defect may only arise from the presence of surface blow-holes in the ingots. These blow-holes, by rolling, are only squeezed together as the thin layer of the oxide coating in the holes prevents them welding firmly together.

That these roundish pieces are not composed of slag is seen by their aspect and the following analyses:—

Per cent of carbon.	
Ingots.	Roundish pieces.
0·23	0·22
0·24	0·24
0·23	0·23
0·25	0·24
0·23	0·22
0·08	0·07

A loss of 0·01 to 0·04 per cent of carbon may happen, as the ingots before rolling are heated in furnaces for 1 to 1½ hours. The ingots are protected from oxidation by covering them by charcoal, and by introducing with the coal pieces of wood dipped into tar in order to obtain a reducing and carbonaceous flame.

The forging of the ingots, after casting, just before rolling them into plates, is not a new idea, but being a rather expensive one is at present nearly abandoned, but altogether the author's opinion is that the only method which gives clean plates is the forging of the ingots *immediately* after casting them. The surfaces of the blow-holes are then clean and easily weld together. Certainly, if blow-holes could be avoided, the manufacture of the plates would be cheaper, but this is still the *bête noire* of metallurgists. M. Gautier tells us that silicon stops the formation of blow-holes, but for steel plates a metal containing much silicon is useless.

Obouchoff Steel Works.

SYNTHESIS OF PHTHALIC ACID.

By M. A. GUYARD.

The phthalic acid here treated of is that derived from naphthalin, and which on fusion with resorcin yields fluorescein, and ultimately eosin.

Synthesis of Phthalic Acid from Salicylic Acid and Carbonic Oxide.—Oxygen, as is well known, is easily fixed upon benzol, so as to yield phenol. Phenol readily absorbs carbonic acid, yielding salicylic acid, and the author has found that the latter, in turn, takes up carbonic oxide with not less avidity, so as to form phthalic acid:—

$$C_6H_6 + O = C_6H_6O.$$
$$C_6H_6O + CO_2 = C_7H_6O_3.$$
$$C_7H_6O_3 + CO = C_8H_6O_4.$$

To effect this synthesis two methods are available:—The one, somewhat rude, consists in heating a mixture of sulphuric acid and potassium ferrocyanide with salicylic acid. When the reaction is over, the phthalic acid is extracted from the mass by treatment with ether. The second method, which is more elegant, consists in heating, as long as gas is evolved, a mixture of sulphuric and formic acids along with salicylic acid. The residual mass is exhausted with the ether, and the extract on evaporation leaves perfectly pure phthalic acid, identical with that obtained from naphthalin. No other product seems to be formed in the reaction.

Synthesis of Phthalic Acid from Resorcin and Carbonic Oxide.—Benzol combines with two atoms of oxygen to form resorcin, and the latter combines with carbonic oxide, yielding phthalic acid. But as this acid is always produced in presence of an excess of resorcin, combination takes place, and fluorescein is at once produced. The synthesis of phthalic acid and that of fluorescein are thus effected at once. For this purpose it is sufficient to heat a mixture of resorcin, and of sulphuric and formic acids. The result, when neutralised with an alkali, shows the beautiful yellow-green fluorescence characteristic of fluorescein. This reaction is exceedingly elegant, no other product being formed.

Synthesis of Phthalic Acid and Fluorescein from Salicylic Acid, Resorcin, and Oxalic Acid.—If salicylic acid is heated with sulphuric and oxalic acids, or if resorcin is heated with the same two acids,—that is to say, with a mixture evolving at once carbonic acid and carbonic oxide,—neither phthalic acid nor fluorescein is obtained. There are formed in this case substances resulting from the combination of salicylic acid, or of resorcin, with carbonic oxide and carbonic acid, but no phthalic derivatives. If, on the contrary, salicylic acid or resorcin is heated with a mixture of oxalic acid and glycerin,—that is, a mixture capable of yielding carbonic acid in the first stage of the operation and carbonic oxide in the second,—phthalic acid or fluorescein appears as soon as carbonic oxide is evolved. These syntheses prove that phthalic acid is the converging point of the two series, benzol and naphthalin. It is derived from the one by construction, and from the other by destruction.

Synthesis of Phthalic Acid from Benzoic Acid.—It is known that phthalic acid is readily transformed into benzoic acid, but the inverse reaction is not easy to effect. But if benzoic acid is carefully heated with bicarbonate of soda and resorcin, and the mass treated with water, a solution is obtained having all the characters of fluorescein.

Synthesis of Phthalic Acid by Juxtaposition and Destruction.—It is highly probable that every mixture which is not physically separated with too great ease, and which contains C_9H_7 to $C_{10}H_8$, will yield, on chemical destruction and decomposition, a little phthalic acid. The author has succeeded in obtaining small quantities of phthalic acid by boiling a mixture of benzyl chloride, C_7H_7Cl, carbon chloride, C_2Cl_6, and nitric acid. The chlorides of benzyl and of carbon do not combine, but they remain for a long time in juxtaposition, and a point arrives when phthalic acid is formed.—*Bull. de la Soc. Chimique de Paris.*

Solids in Milk.—According to the *Chemiker-Zeitung* (No. 17, April 26, 1878), a certain Theodor Kyll, of Cologne, vouches for the excellence of the milk, sold in G. Palant's Milk-Cure Establishment, in that city, on the mere ground that it contains 12·70 per cent of total solids. Dr. H. Vohl points out the utter insufficiency of a determination of total solids, and shows that the quantity given by Kyll is decidedly below the average, which is, according to Liebig, 14, and according to Reichardt, 13·725 per cent.

IMPROVEMENTS IN THE METHOD OF PRESERVING ANIMAL AND VEGETABLE FOOD.

We have received a number of biscuits and other preparations containing preserved solid and liquid food, both animal and vegetable, which are the practical results of a new process lately patented by Dr. Campbell Morfit. They include substances of the most diverse nature, such as milk, cream, cheese, beef, garden rhubarb, cabbage, tomato, pork sausage, and a variety of other alimentary products, all of which are perfectly savoury and toothsome, in spite of their being more than a year old. It is, however, more with Dr. Morfit's process than with its present results that we have now to deal, for we must look upon his discovery as being as yet in its infancy.

Dr. Morfit's experiments, which he has prosecuted uninterruptedly for the last two years, seem to prove that ordinary gelatin, when it is once thoroughly diffused through a vegetable or animal substance, and dried in and with it, will protect it from decomposition or other alteration for a prolonged period, in spite of atmospheric or climatic changes. This is clearly proved by the samples submitted to us, which—although they have been exposed to the constant changes of temperature and moisture consequent on their having been kept for more than a year in the store-room of an ordinary dwelling-house—are still perfectly good and sweet, their natural characteristic flavours being well preserved. Some lime-fruit juice biscuits, for instance, which are more than a year old, have preserved, in a very perfect manner, the peculiar flavour by which the juice of the lime can always be distinguished from that of the lemon.

The primary principle of Dr. Morfit's process is the getting rid of nearly the whole of the natural water contained in the substance to be preserved, by submitting it to a certain degree of heat, the place of the water being supplied by gelatin. The compound is then dried, and in this state may be kept for any length of time, or else it may be made up into biscuits by incorporating it with biscuit-powder.

Let us take Dr. Morfit's method of preserving beef as an example. The beef must be as free from fat and bone as possible, and should be first stewed in its own liquor, or with the least possible quantity of water, and seasoned or not according to taste. The whole is then reduced, by any available mechanical means, to a state of smooth and fine pulp, and triturated with a solution of gelatin in water. One pound of gelatin is enough for 15 lbs. of meat, fowl, or fish, the gelatin being dissolved either in a sufficiency of water or in the natural juice of the substance itself. In the case of fruit—such as gooseberries, currants, or plums—they are stoned or skinned when necessary, and cooked or not, as the case may be. They are then made into a pulp and mixed with gelatin dissolved in water or their own juice, heated so as to insure a thorough mixture of the ingredients, and then poured into coolers. In certain cases the gelatin may be replaced by mucilage of Irish moss, but the result, although cheaper, is not so good.

Dr. Morfit's method of condensing milk without the use of sugar is of great interest, seeing that the Swiss and other descriptions of condensed milk, which are now so largely sold, cannot be taken by delicate infants or by persons of weak digestion, owing to the large amount of sugar contained in them. One pound of gelatin is dissolved in 1 gallon of fresh milk at a temperature of from 130° to 140° F., the whole being allowed to set into a jelly, which is dried. The dried jelly is then dissolved in another gallon of fresh milk, and allowed to set and dry as before, the operation being repeated with fresh milk until the original pound of gelatin has taken up eight gallons of milk or more. Consommé of meat may in like manner be condensed until one pound solid shall represent thirty times its weight of fresh beef. As may be readily guessed, the process may be carried on without any of the

expensive plant and troublesome manipulation involved in the usual modes of condensing milk and making Liebig's extract, besides which, in the latter case, the whole of the nitrogenous parts of the meat are preserved intact.

From a hygienic point of view, the lime-fruit juice biscuits ought to be admirably suited for use in the Navy. Without entering into the question as to whether it is the citric acid, or the phosphatic salts, or the potash, contained in the lime-juice that is the real anti-scorbutic agent, it is sufficient to say that the 40 per cent of Montserrat lime-fruit juice preserved by Dr. Morfit's process, and incorporated with the biscuits, has preserved all its properties without any change for more than a year, and, *à priori*, there is no reason to suppose that it would not keep good for ten or twenty times that period. It may be mentioned, in conclusion, that the different jellies may be dried into hard tablets or flakes at a uniform temperature of from 38° to 40° C., and sent into the market in this convenient form, as well as under the more bulky guise of biscuits. A few cases of lime-fruit juice tablets, prepared according to Dr. Morfit's method, would probably have saved the lives of several brave men during the late expedition to the Polar regions.

Speaking from a purely scientific point of view, and judging by the results we have already described, the principle of Dr. Morfit's invention seems to be theoretically a sound one. These results we must regard at present as tentative, and it only remains to the inventor of the process to confer a large benefit on the community by extending its application, thereby notably increasing our not too abundant stock of hygienic and alimentary products.

PROCEEDINGS OF SOCIETIES.

PHYSICAL SOCIETY.

May 25, 1878.

Prof. W. G. ADAMS, President, in the Chair.

THE following candidates were elected members of the Society :—W. Kieser, T. McEniry, W. R. Philips, G. M. Whipple.

Mr. D. J. BLAIKLEY read a paper on "*Brass Wind Instruments as Resonators*," describing an attempt he has made to carry into some detail certain acoustical investigations of the late Sir C. Wheatstone, who proved experimentally that a complete cone gave resonance to the same notes as an open cylindrical tube of equal length. A method by which the positions of the nodal points in a cone and in a bugle had been fixed was shown, and attention was drawn to the fact that the position of the centre of magnitude of any closed conical tube was at the same distance from the open end as the centre of magnitude of a closed cylindrical tube of the same pitch. It was then shown that a complete cone cannot be used by the lips as a wind-instrument, that conic frustra cannot give resonance to the same series of notes as complete cones, and that, therefore, the conical form must be modified; and, as this modification of form makes the position of a node for every note required more or less coincide with that of the lips, so will the instrument be more or less perfectly in tune. As the number of quarter wave-lengths in a cone or wind instrument is not directly proportional to the vibrational number of the note, as it is in free space or in an open tube, so the velocity of the wave of a given note is not exactly the same as that of another note of different pitch. Experiments were shown to illustrate the effect of varieties of form in producing different qualities of tone, and evidence was given of the existence of very high harmonic or partial tones in the low notes of wind instruments. In the trombone the ninth partial tone (three octaves and a tone above its prime) was thus proved to be sounding, and partial tones up to the sixteenth have been heard. In conclusion a summary was given of the partial tones sounding in the tones of different instruments, and attention was drawn to the chief differences in form which influence quality of tone.

Sir W. THOMSON pointed out the connection between the range of a musical instrument and the phenomena observed in a trumpet-shaped bay between high and low water; and he considered that an investigation of the overtones due to the cavity of the mouth would well repay research in explaining the influence its shape has on the vowel sounds.

Lord RAYLEIGH observed that in a conical musical instrument the correction to be made on account of the cone not being perfect to the apex is equal to six-tenths of the radius of the open end, and he pointed out that with a bell-mouthed instrument much of the sound is diffused as spherical waves.

Dr. GUTHRIE placed on the table a communication on salt solutions and attached water, and on the separation of water from crystalline solids in currents of dry air, in continuation of his researches, which have already been published. The results could not be usefully abstracted, but as an instance of the important results obtained it may be mentioned that Dr. Guthrie finds that when dry air is passed over chloride of barium at a temperature just above 25° C. the β-molecule of water is given off, and that the α-molecule of water is only separated at a temperature just above 60° C. In studying the effect of media other than water in the solution of salts, he finds, for instance, that two solutions of cobalt of equal strength differ greatly as to colour if they are formed with water and glycerin. He has also traced the influence of a colloid in modifying the crystalline form of salts; for instance, sulphate of copper crystallises from gelatin in the globular form, retaining only $3\frac{1}{2}$ molecules of water. He also showed the effect of a steam jet in boring through a block of ice, mainly with a view of obtaining suggestions as to the use of such a method in the commercial preparation of ice.

Mr. RUTHERFORD then showed a photograph of the solar spectrum from the line E to H, taken by means of a grating. By means of a heliostat he concentrated the rays on a lens within a collimator, which, in relation to the observing telescope, was of considerable length in order to admit as much light as possible, and the grating was movable. The enlargement was effected by inserting a lens near the focal point of the observing telescope, and he used a sensitive collodion which gave the greatest sharpness of definition about the line G.

Sir W. THOMSON hoped that Mr. Rutherford would measure the wave-lengths of dull radiant heat, as such rays are not absorbed by speculum metal, and we have as yet no idea of the lower limit of the waves of heat.

Sir W. THOMSON, in continuation of the communication made to the Society at its last meeting, described the effect of torsion on the electric conductivity of a tube of brass. He showed that the effects of pull and thrust were different, and in the case of a tube, as in the case of a plate, there is a diminution in conductivity in the direction of pull; in the case of the tube, however, the components of the forces result in a sort of eschelon arrangement as regards conductivity. The experimental part of the work was conducted by fixing the tube to a collar of brass which was attached to a stand, the tube being arranged in a horizontal position. A magnetometer bearing a mirror could be placed inside the tube, and the changes in its conductivity produced by torsion were rendered evident by a reflected beam of light. The effects were also investigated by placing a core of soft iron in the tube, a balanced magnetometer being arranged outside the tube, near one end of the soft iron. Any changes in the conductivity of the tube induced by torsion were rendered

evident by the changes in the amount of magnetism induced in the soft iron as indicated by the magnetometer.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, April 16, 1878.

E. W. BINNEY, F.R.S., F.G.S., President, in the Chair.

"*Note on the Occurrence of Dioptase on Chrysocolla from Peru*," by CHARLES A. BURGHARDT, Ph.D., the Owens College.

A short time ago, Mr. W. M. Hutchings, F.C.S., of Birkenhead, sent me some specimens of chrysocolla ($CuSiO_2+2H_2O$), from Peru, accompanied with a statement that there were some minute crystals in a cavity in one or two of the specimens which might possibly prove to be the rare mineral dioptase ($CuSiO_2+H_2O$). I proceeded to make a crystallographical and chemical examination of the crystals, and found that although extremely small, the forms could be recognised under the microscope. The chrysocolla mass is eaten into in one or two spots, cavities being produced, which are divided into numerous cells by the intersection of thin partitions of chrysocolla substance. The dioptase crystals occur particularly fine in small green tufts and sheaves attached to the partition-walls of the cells, whilst those crystals clothing the interior of the cells are not so well developed as the others. The measurements so far obtained have not been satisfactory, owing to the extreme smallness of the crystals, but the forms observed are those peculiarly characteristic of dioptase, viz., $\infty P2$—$2R$; the rhombohedron being extremely well defined. No other forms were observed, but a great many fine acicular sub-individuals growing parallel with each other build up a large individual. Some of the crystals I carefully picked out and examined chemically with the following results, viz.:—Heated before the blowpipe they were infusible and turned brown, *not black*, probably owing to one of two causes, either (1) the flame was not a pure oxidising flame, and a little of the cupric oxide was reduced to cuprous oxide; or (2) there was a slight admixture of quartz with the dioptase crystals. The presence of copper was proved by dissolving a crystal in a drop of hydrochloric acid, evaporating off the latter, re-dissolving the residue in a drop of acetic acid and adding potassium ferrocyanide, when the characteristic copper reaction was very marked. There was not the slightest effervescence on dissolving the mineral in hydrochloric acid, but flocculent particles of silica separated out. Mr. Hutchings obtained identical results in a chemical examination of the crystals. From the above tests, the crystallographical examination, and the fine emerald-green colour of the crystals, there can scarcely be a doubt that they are really those of dioptase. Colourless quartz crystals were also observed associated here and there with the dioptase, but $+R$ and $-R$ were both present, generally nearly in equilibrium, and the prism faces exhibited strongly the characteristic horizontal striation; therefore, coupling the marked differences in colour and crystal-form, a confusion of the two minerals could scarcely be possible.

I believe this is the first instance observed of dioptase occurring simultaneously with chrysocolla, and according to my knowledge the first time it has been found in Peru—in fact, out of Russia. The exact locality of the mine cannot unfortunately be ascertained. I am of opinion that the dioptase has been formed by the action of water upon the chrysocolla, the latter being a product of the decomposition of cuprite (which is always intimately associated with it) by a solution of silicic acid in water. Very fine botryoidal malachite sometimes occurs associated with chrysocolla and cuprite in the same locality in Peru. I hope shortly to obtain accurate measurements of the dioptase crystals.

"*On Indigo-blue from* Polygonum tinctorium *and other Plants*," by EDWARD SCHUNCK, Ph.D., F.R.S.

The author, after referring to his investigation of *Isatis tinctoria*, the common woad plant, the results of which were communicated to the Society many years ago (*Memoirs*, 2nd series, xii., p. 177, and xiv., p. 181), proceeded to give an account of some experiments he had recently made with *Polygonum tinctorium*, a plant employed by the Chinese for the manufacture of indigo, his object being to ascertain whether the colouring matter is contained in this plant in the same form as in the *Isatis*, viz., as a glucoside. His experiments led to the conclusion that the leaves of *P. tinctorium* contain a substance which cannot be distinguished from the indican of the woad plant. It is amorphous, soluble in water, alcohol, and ether, and by the action of acids is decomposed into indigo-blue and a substance giving the reaction of glucose, probably indigucine. When its watery solution is boiled or left to stand for some time, it undergoes a complete change, and then no longer yields indigo-blue by decomposition with acids, but indigo-red and other products, indican, as formerly shown, undergoing a similar metamorphosis under the same circumstances.

The author recommends for the preparation of this substance the following process:—The leaves of the plant having been carefully dried, are ground to powder, and extracted with spirits of wine. The green alcoholic extract is evaporated at the ordinary temperature, a current of air being employed to assist evaporation. After evaporation of the alcohol there is left a brown watery liquid, which is filtered from the deposited chlorophyll and fatty matters, and mixed with acetate of lead solution. This gives a copious dirty yellow precipitate, which is filtered off. Basic lead acetate added to the filtrate produces a primrose-yellow precipitate, which is filtered off, washed with water, then with alcohol, and then suspended in absolute alcohol. On passing a current of carbonic acid gas through the liquid the precipitate is decomposed, yielding lead carbonate, while the liquid acquires a yellow colour. The filtrate is evaporated in a current of air, and water is added to the residue, which it dissolves for the most part. Sulphuretted hydrogen is passed through the filtrate to precipitate the lead in solution, and the liquid after filtration is again evaporated. The residue is treated with ether, which leaves a portion undissolved. The ethereal solution leaves on evaporation a yellow amorphous residue, having all the properties of indican.

The author made some experiments with the fresh leaves of the plant, from which he concludes that the leaf-cells contain no ready-formed colouring matter with the exception of chlorophyll, and that the indigo-blue which is formed when the vitality of the cells is destroyed by extreme cold, organic lesion, or chemical reagents is produced by the decomposition of indican, which commences as soon as the protecting influence of the living cell is removed.

It has long been known that some orchidaceous plants, such as *Bletia Tankervilliæ* and *Callanthe veratrifolia*, yield indigo-blue. The author examined the leaves of the former plant, and obtained a solution giving the reactions of indican, and he is consequently inclined to suppose that the latter will be found in all cases to be the source from which indigo-blue is derived.

The author mentions a fact which he thinks may be of interest not only to the chemist, but also to the physiologist. On one occasion an alcoholic extract of dried woad leaves, in which the indican had undergone partial decomposition by long standing, yielded on evaporation a quantity of a substance which, when purified, was found to have all the properties of tyrosine. Though it is possible that the tyrosine may have pre-existed in the plant, the author is inclined to think that, like the leucine previously discovered by him, it was a product of decomposition of indican under conditions of which he is at present ignorant, especially as some connection is supposed by chemists to exist between tyrosine and indigo-

blue; and on the other hand, tyrosine and leucine so frequently occur together as products of decomposition of protein compounds.

"*On the Estimation of Hyposulphites and Sulphites*," by J. GROSSMAN, Ph.D. Communicated by Prof. ROSCOE, F.R.S.

Bunsen, in his treatise "On a Volumetric Method of Very General Applicability" (*Ann. Chem. Pharm.*), has shown what degree of exactness may under certain circumstances be attained by indirect analysis. Upon the latter I have founded a very simple method for the estimation of hyposulphites and sulphites, which yields exact results. I shall speak in the following only of the sodium salts of the above compounds, as it will make the explanation clearer.

Let us assume, first, that we have only a mixture of sodium hyposulphite and sulphite, free from sulphate, in solution. If, on the one hand, we estimate how many grammes of iodine are required by an aliquot part of the mixture—acidulated with acetic acid—to yield the well known final blue reaction with starch; and if, on the other hand, we find how many grammes of sodium sulphate an equal measure of the mixture yields on perfect oxidation with chlorine or bromine, all the data necessary for the calculation of the respective quantities of hyposulphite and sulphite are in our possession, and we can form two equations from which both the unknown quantities x_1 and y_1 can easily be calculated.

Let x_1 = grms. iodine corresponding to $Na_2S_2O_3$ present.
Let y_1 = grms. iodine corresponding to Na_2SO_3 ,,
Let A = the quantity of iodine which the unit requires for testing with starch.
And B = grms. Na_2SO_4, which the unit yields on perfect oxidation,

Then—

$$x_1 + y_1 = A$$

$$\frac{2Na_2SO_4}{Na_2S_2O_3} \cdot \frac{Na_2S_2O_3}{I} \cdot x_1 + \frac{Na_2SO_4}{Na_2SO_3} \cdot \frac{Na_2SO_3}{2I} \cdot y_1 = B.$$

Or—

$$\frac{2Na_2SO_4}{I} x_1 + \frac{Na_2SO_4}{2I} \cdot y_1 = B.$$

Which gives us—

$$x_1 = \frac{2I}{3Na_2SO_4} \cdot B - \tfrac{1}{3}A.$$

$$y_1 = \tfrac{4}{3}A - \frac{2I}{3Na_2SO_4} \cdot B.$$

To get the result as grms. $Na_2S_2O_3$ and Na_2SO_3 it is only necessary to multiply x_1 by—

$$\frac{Na_2S_2O_3}{I}, \text{ and } y_1 \text{ by } \frac{Na_2SO_3}{2I}.$$

From this we find x = grms. $Na_2S_2O_3$ =

$$\frac{2Na_2S_2O_3}{3Na_2SO_4} \cdot B - \frac{Na_2S_2O_3}{3I} \cdot A =$$

$$= 0{\cdot}741784\,B - 0{\cdot}414698\,A.$$

y = grms. Na_2SO_3 =

$$\frac{2Na_2SO_3}{3I} \cdot A - \frac{Na_2SO_3}{3Na_2SO_4} \cdot B =$$

$$= 0{\cdot}661417\,A - 0{\cdot}295775\,B.$$

Care must of course be taken that the dilution while titrating is sufficient, and at least two titrations ought to be made.

If besides hyposulphite and sulphite sulphate is present, it is necessary to estimate this by itself, and the Na_2SO_4 thus found subtracted from the total Na_2SO_4 is B. As long as there is no sulphide present this can be done in the following manner:—The liquor to be examined is heated in a flask, and carbonic acid passed through till all the air is expelled. Then hydrochloric acid is added in excess, and the liquid boiled down in a CO_2 atmosphere to one-fourth of its volume. After filtering, it is precipitated with barium chloride as usual.

0·21385 grms. Na_2SO_4 were mixed with a very great excess of $Na_2S_2O_3$ and Na_2SO_3, and yielded, after being treated as described above, 0·2151 grm. Na_2SO_4. If sulphide is present this must be got rid of by means of cadmium carbonate before starting the analysis.

A mixture was prepared, containing per unit,—

Na_2SO_4	0·4165	grm. =	39·06
$Na_2S_2O_3$	0·3946	,,	37·01
Na_2SO_3	0·2551	,,	23·93
	1·0662		100·00

And the following data got—

Total Na_2SO_4	1·4174 grms.
Actual Na_2SO_4	0·4165 ,,

Therefore B = 1·000900
A = 0·833189.

From which we calculate—

Na_2SO_4	0·4165	grm. =	38·98
$Na_2S_2O_3$	0·3969	,,	37·15
Na_2SO_3	0·2550	,,	23·87
	1·0684		100·00

I have used this method with great advantage in the analysis of intermediate as well as final products in the manufacture of soda-ash and caustic soda.

"*Note on the Action of Iodine Trichloride upon Carbon Bisulphide*," by J. B. HANNAY, F.R.S.E., F.C.S.

It is stated by Weber that when iodine trichloride is added to carbon bisulphide a new product is formed. Now I have examined the action of these two substances upon each other, and find it is according to the following equation:—$2CS_2 + 3ICl_3 = CCl_4 + CSCl_2 + 3SCl + 3I$.

On adding carbon bisulphide to pure iodine trichloride till it was all decomposed considerable heat was evolved, and on cooling iodine crystallised out. A qualitative examination of the liquid showed the presence of sulphur chloride in large quantities, and on decomposing this with water, the characteristic smell of the sulpho-chloride of carbon was observed. This was further recognised by its deportment with alkalies, and after its removal from the liquid, the tetrachloride of carbon was easily recognised by its peculiar sweet smell, strongly reminding one of the smell of primrose leaves.

A weighed portion of the trichloride was heated with the requisite amount of carbon bisulphide to convert it into the above products, when it was found there was neither an excess of carbon bisulphide nor of the trichloride present. The liquid was allowed to cool, and when all the iodine had crystallised out, it was passed through a small filter of asbestos, and washed with a few drops of carbon tetrachloride. The iodine on the filter was estimated, and gave only a little under the required amount. The filtrate was then treated with caustic potash, and the separated carbon tetrachloride weighed after transference to a tared bulb. The sulphur in the liquid, left after removal of the tetrachloride of carbon, was oxidised by means of potassium chlorate and strong nitric acid, and estimated as barium sulphate.

The following table gives the figures which were obtained on working with 10 grms. of iodine trichloride, and also those deduced from the above equation:—

	Found.	Calculated.
CCl_4	2·05	2·198
$CSCl_2$	1·71	1·641
CS_2Cl_2	2·90	2·890
I	5·37	5·428

Specific Heat of Beryllium (Glucinum).—L. F. Nilson and O. Petterson.—The specific heat of glucinium is 0·4079. It belongs not to the magnesian but to the aluminium group of metals, and glucina is a sesquioxide. —*Ber. der Deut. Chem. Gesell.*

NOTICES OF BOOKS.

Food ; some Account of its Sources, Constituents, and Uses. By A. H. Church, Professor of Chemistry in the Agricultural College, Cirencester. Published for the Committee of Council on Education by Chapman and Hall.

This treatise forms one of the "South Kensington Museum Science Handbooks," and is, as we learn from the preface, in the first place, intended for the instruction of those visitors to the Bethnal Green Museum who may wish to study the collection of food-products there displayed, and secondarily for the benefit of persons who have no facilities for inspecting the specimens there displayed. Both these purposes seem to us to have been very fairly accomplished. The medical practitioner or the chemist will not indeed find much with which he was not already acquainted. No novel views are brought forward, and the author's original work—which has certainly been considerable—has been chiefly undertaken with a view of checking the commonly received composition of various articles of diet. On the other hand, the British public, even the "respectable and intelligent portion," will find here not a little useful information of which it is too commonly ignorant to its loss and to the emolument of quacks and pretenders. It may open the eyes of some people who feed their young children upon so-called "corn-flours," to be told that "these products are not flour, but nearly pure starch, and that they contain mere traces of bone-forming and flesh-forming materials." All this, it is true, has been said before, but in a work like the present, prepared at the request of the Committee of Council on Education it will, perhaps, carry the needful authority. In 1 lb. of "corn-flour" the author found only 18 grains of flesh-formers, whilst in the original maize there are 1 oz. 193 grains, or 35 times as much! Yet John Bull is found willing to buy the deteriorated article at a higher price. The preparations of lentils, also sold at enormous prices under fanciful names, do not escape the author's scrutiny. The following passage also is highly satisfactory: —"In order that coffee may be enjoyed in perfection, not only must it be free from admixture with the cheap and miserable adulterants commonly stated to improve its taste, but it must be freshly roasted to the right extent, freshly ground, and so made into a beverage that its soluble constituents are extracted without its aroma being dissipated." Concerning Paraguay tea, or maté, which some persons are striving to bring into common use in Europe, Mr. Church remarks that it does not yield a wholesome beverage fit for habitual use. "It acts upon the nervous system mainly, but it affects the digestive tract (!) also, and often injuriously."

The author's condemnation of so-called British wines as "not generally wholesome" is very just, as far as regards those ordinarily manufactured for sale, especially if prepared from rhubarb, a vegetable whose very questionable action on the human system is not atoned for by any delicacy of flavour. But we have met with current-wine over twenty years in bottle, and perfectly free from "fortification," in which a very fine bouquet had been developed. The fact that the other vegetable acids, unlike the tartaric, are not separated out in the form of sparingly-soluble salts is doubtless condemnatory of any fruit or stalk containing oxalic acid, but it is of much less importance where the citric and malic only are present.

We regret to find here no reference to the great superiority of the fruit-vinegars over those prepared from malt or from starch. Apple-vinegars are in very extensive use in the United States, and preserve the delightful aroma of the fresh fruit.

As regards nitro-benzol, sometimes improperly used instead of oil of bitter almonds, the author very properly points out that it is not merely poisonous, but has a much less agreeable odour and taste than the true oil. Nor does he consider it proved that the artificial fruit-essences are really identical with the natural flavours which they closely simulate. We have known instances of alarming symptoms following upon a very moderate dose of so-called "Champagne cider," in the concoction of which no apples had been employed. The unpleasant effects of many samples of raspberry cordial and raspberry vinegar, commonly ascribed to magenta, supposed to have been used in giving a factitious colour, are, according to Dr Reimann, very possibly due to the essence employed to simulate the flavour of the raspberry. Artificial vanillin, Mr. Church observes, is not a mere imitation of the natural product, but is absolutely identical therewith. Our author's estimate of Liebig's extract of meat agrees with that of most recent authorities. It is a stimulant and flavourer rather than a substantive food. In the foods for infants prepared from farinaceous matters by converting their fecula into dextrin and glucose there is often a deficiency of flesh-formers, and we have heard from medical friends of not a few instances where their prolonged use has led to disastrous consequences. It is, if we may use the expression, a curious whim, that while the human infant, like the young both of mammalia and of most birds, requires and receives at first an exclusively animal diet, yet when weaned it is too often put upon an exclusively vegetable regimen sadly deficient in blood-forming ingredients.

We hope that Mr. Church's work will be widely read, and that its teachings will be acted upon.

Plain Words about Water. By A. H. Church, Professor of Chemistry in the Agricultural College, Cirencester. Published for the Committee of Council on Education. Chapman and Hall, Piccadilly.

We have here a useful little treatise, calculated to be of great public service. The author speaks in the first place of water as forming part of the human body, as well as in plants and animals generally, and explains its physiological functions. He then turns to the proportion of water present in certain articles of daily food, which he illustrates by a diagram. An examination of our water-supply next follows. Mr. Church explains the dangers of river-water if used for domestic purposes, and the still greater risk attending the consumption of a supply from shallow wells. He gives a sectional diagram of a well sunk in a gravelly soil down to the clay, rock, or other more impermeable substratum, and in friendly proximity to the cess-pool, an interchange of liquid taking place between the two according to its temporary height in each. As an instance in point, he mentions that a well which supplied several cottages with water suddenly failed. On examination the reason was soon discovered: the owner of an adjoining house had cut off the supply from a water closet, and substituted an earth-closet. In all this account of shallow wells and their feeders there is nothing in the least sensational or exaggerated. In country places we have repeatedly observed the well serving for a row of cottages separated from the cesspool merely by three or four yards of gravel or chalk, sufficient indeed to remove visible impurities and confer a delusive appearance of brightness, but utterly unable to remove dissolved impurities or those minute organisms which are supposed to convey cholera and typhoid fever. The author does not think it likely that Thames water, however filtered, and however guarded from known and divertible impurities in the upper parts of the river, can become a satisfactory source for the greater part of London.

The remainder of the work is devoted to a description of the means of testing waters, and of purifying such as are more or less charged with foreign matter. As he is addressing himself not to professional men but to the British public at large, he does not, of course, enter into quantitative methods, but recommends the application of

a few simple qualitative tests, such as nitrate of silver, molybdate of ammonia, permanganate, Nessler's liquid, along with a careful observation of the colour, transparency, and odour of the water.

A Hand-book of Volumetric Analysis. Designed for the use of Classes in Colleges and Technical Schools. By EDWARD HART. New York: J. Wiley and Sons. London: Trübner and Co.

LIKE every other subject connected with chemistry, volumetric analysis is made the subject of no small number of treatises and manuals. The work before us, though calculated to be useful to students, does not present any broadly characteristic feature. The author describes first the instruments used, then points out certain sources of error too often overlooked, and passes next to the preparation of standard solutions. The volumetric methods are then described under the three heads of saturation, oxidation or reduction, and precipitation. In addition to the metals, processes are given for the volumetric determination of the ordinary organic acids, such as oxalic, acetic, formic, tartaric, &c., as also for sugar, phenol, the compound ethers, chloral hydrate, urine, and indigo. For the latter substance he recommends the permanganate process, admitting, however, that it is not free from objections. For the determination of tannin, a question which may almost be called an opprobrium of technical analysis, the author gives the raw hide method of Hammer, and Löwenthal's permanganate process. He quotes the statement of Oser, that 1 c.c. permanganate = 0·006236 grm. oak-bark tannin, and that of Neubauer, that the same volume represents only 0·004155 grm. of the tannin of gall-nuts. Hence either different varieties of tannin are not mutually comparative, as Löwenthal himself holds, or the termination of the process is not sufficiently well defined.

For the determination of free oxygen in water—a favourite method in France for ascertaining its comparative impurity—the author recommends the process of Schützenberger and Risler, the use of hydrosulphite of sodium with Coupier's blue as an indicator. We regret much that certain modern authorities on chemical nomenclature have given to Schützenberger's "hydrosulphite" the name "hyposulphite."

Elements of Chemistry; Theoretical and Practical. By W. A. MILLER, M.D., &c., late Professor of Chemistry in King's College, London. Revised by HERBERT MCLEOD, F.C.S., Professor of Experimental Science, Royal Indian Engineering College. Part I., Chemical Physics. Sixth Edition. Longmans and Co.

DR. MILLER'S work has become so widely and favourably known during the two and twenty years that it has been before the public as to render criticism superfluous. The present edition appears to have been carefully revised in accordance with the most recent researches; the references have been verified, and all tables and other numerical matter re-calculated.

How to Work with the Spectroscope; a Manual of Practical Manipulation with Spectroscopes of all kinds. By JOHN BROWNING, F.R.A.S., F.R.M.S., &c.

THIS little book contains descriptions and figures of most of the great variety of spectroscopic apparatus now in use, for the construction of which the author has deservedly become famous. The construction of each instrument is briefly, yet clearly, described, and a somewhat detailed account given of the way of using it, either by itself, or when needed, in combination with the telescope or microscope.

Spectroscopes, like many other instruments, are now constructed in so many ways, and used for so many purposes, that even persons accustomed to scientific instruments sometimes feel at a loss, when a new instrument comes into their hands; to such Mr. Browning's directions will be of great service, and of still more use to those who, without any previous experience, and probably unaided, are commencing spectroscopic investigations.

Full directions are also given for the management of the electric light, and the exhibition of spectra upon a screen. Also the methods of constructing spectrum maps with the various instruments contrived for that purpose.

CORRESPONDENCE.

THE EUDIOMETRIC ANALYSIS OF MIXTURES OF PARAFFINS.

To the Editor of the Chemical News.

SIR,—Messrs. Morton and Geyer, in their paper on "Water Gas" in the CHEMICAL NEWS (vol. xxxvii., p. 187), fill a whole column with mathematical formulæ in order to prove that it is not possible to ascertain the proximate composition of a mixed paraffin by means of eudiometric analysis. I wonder how they managed to get through all this laborious calculation without seeing that the same result may be arrived at by two lines of common-sense reasoning.

A paraffin, as the general formula C_nH_{2n+2} shows, contain x in every one standard volume (*i.e.*, in the volume of H_2) the elements of one molecule of hydrogen, H_2 + the elements of an olefine, C_nH_{2n}, and the same is the case with any *mixture* of paraffins; because, whatever may be the names of the individual paraffins which are mixed together, we always have H_2 per standard volume + something of the composition C_nH_{2n}, although of course the "n" is not in general an integer. Hence, the elementary composition of a mixed or simple paraffin C_nH_{2n+2} is *completely determined* when we have ascertained the "n," *i.e.*, the number of volumes of carbon vapour contained in 2 volumes; and supposing even the n to turn out an integer the gas may nevertheless be a mixture. For a gas containing n volumes of C per 2 vols. may be produced in an infinite variety of ways by mixing together hydrogen or lower paraffins with higher paraffins (even by twos), and the mixture, as we saw, is always bound to contain C_xH_{2x+2} per 2 vols.

What I have just tried to explain may easily be expanded into a larger proposition, of which I wonder that it is nowhere explicity stated, except in my own article "On Gas Analysis" in the new "Handwörterbuch."

Supposing we knew a gas to contain $C\alpha H\beta N\gamma O\delta$ per 2 vols., and it is clear that from this formula we might calculate out *all* the data that the eudiometric analysis of the gas could possibly bring out. Hence, conversely, if the data are given it is impossible to extract from *them* anything over and above the formula, *i.e.*, the elementary composition of unit volume.

The very general custom of reducing the data of the eudiometric analysis of even highly complex combustible gas-mixtures which are not susceptible of *actual* analysis to imaginary percentages of C_2H_4, C_3H_6, &c., &c., is only a clumsy mode of stating that the gas contains so and so much C, H, O, &c., per 100 volumes. Why not give these percentages themselves in plain figures?—I am, &c.,

W. DITTMAR.

Anderson's College, Glasgow,
May 11, 1878.

ANALYSES OF STEEL.

To the Editor of the Chemical News.

MR. SERGIUS KERN publishes in your journal of the 17th inst. a series of analyses of steel, in which the sulphur and phosphorus are given in most cases as *nil*, some as a

trace, and in some cases only does he give phosphorus and sulphur, the highest estimation of phosphorus being 0·03 per cent.

My experience (a very extensive one) in the examination of steel—certainly all English made steels used for axles, rails, plates, tyres, &c.—is that it universally contains a weighable amount of phosphorus, and only in very rare instances are such steels free from sulphur. Swedish iron, also, as a rule contains a weighable amount of phosphorus; only in exceptional cases do I find even traces. Am I to understand that the steel examined by Mr. Kern is exceptionally pure? Were I to express an opinion, I should say that his methods of analysis are at fault, and certainly not adapted to detect small quantities of sulphur and phosphorus. I would also observe that the manganese determinations are all unusually low, and I think it is more than probable a similar cause may account for this. —I am, &c.,

EDWARD RILEY.

London, May 27, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 16, April 22, 1878.

Second Note on the Vision of Colours.—E. Chevreul.—The athor treats of the influence of his laws of the simultaneous contrast, the successive contrast, and the mixed contrast of colours, and gives instances of their application. He mentions that if grey or white designs are to be produced upon a coloured ground it is necessary to add to the grey or the white a trace of the colour of the ground to prevent the appearance of its complementary colour. In an experiment with revolving discs painted half smoke-black and half white, the colours being divided by a diameter, on rapid motion the whole appeared of a uniform grey, but on slow motion the white took a yellow shade with a cast of red, and rising from the 1st to the 7·5th, and even to the 8th tone, whilst the black certainly took a blue-violet shade.

Researches on the Action of Dried Oxalic Acid upon the Primary, Secondary, and Tertiary Alcohols. MM. Cahours and Demarcay.—The action of dry oxalic acid upon the tertiary alcohols, which consists in resolving them into hydrocarbides and into water which combines with the oxalic acid, establishes a very well-defined distinction between these compounds and the primary and secondary alcohols; both the latter being under similar circumstances transformed into oxalates. Similar results might doubtless be obtained by causing dry oxalic acid to act upon the so-called pseudo-alcohols.

Results of Éperiments made in Various Parts of Algeria on the Industrial Application of Solar Heat. —M. Mouchot.—The author has first endeavoured to ascertain what metals are best adapted for reflectors. He gives the preference to brass, upon which a thin layer of silver has been deposited by galvanism. The daily variations of heat, with a clear sky, are not very sensible between 8 a.m. and 4 p.m. The intensity of the heat collected is satisfactory between 6 a.m. and 7 a.m.; it increases rapidly from 7 p.m. to 8 p.m., and decreases between 4 p.m. and 6 p.m. The quantity of heat collected at Algiers per minute per square metre was 7 calories in April, 8 in May, and 8·5 in June and July. A yield of 7 calories proves that a reflector of a square metre would boil in less than 12 minutes a litre of water at 20°, and give hourly 1322 litres of steam at the normal pressure. These results are only two-thirds of what may be attained with receivers of larger size. The author thinks that he has succeeded in popularising the small solar apparatus suited for cooking food, baking bread, distilling alcohol, &c.

Observations Relating to the Paper of MM. Moitessier and R. Engel upon Chloral Hydrate.—L. Troost.—The author shows that the observations of MM. Moitessier and Engel furnish no argument against the existence of chloral hydrate in the state of a definite gaseous compound, distinct from a mixture of its elements, water and chloral.

Formation of Metallic Arsenides.—A. Descamps.—On attempting to prepare metallic arsenides by submitting arsenites or arseniates to the reducing action of hydrogen, carbonic oxide, or coal-gas, the author obtained very imperfect results. He also reduced arseniates in a crucible with potassium cyanide in excess, so as to form a liquid layer which might preserve the compound from the action of the atmosphere. In these experiments he continued the application of heat till arsenical vapours no longer escaped. With many metals, however, arsenic does not form absolutely definite compounds, but alloys, which, after being heated for a certain time, may lose arsenic and change their composition. He has also prepared arsenides by the direct action of metallic arsenic upon the metal in a current of hydrogen, or, preferably, by heating the metal in a crucible along with excess of arsenic and borax as a flux. The arsenides of copper, gold, and silver have been prepared by placing metallic arsenic in solutions of copper sulphate, silver sulphate, or gold chloride.

Determination of Natural Tartrate of Lime in Crude Tartars.—A. Scheurer-Kestner.—Tartars, lees, &c., are essentially composed of potassium bitartrate, with which calcium tartrate is often mixed. For the determination of the potassium bitartrate a standard alkaline liquid is generally caused to act upon a hot solution of the sample in water. But it has been found that this process leads to exaggerated results. Certain tartars, and especially certain lees, contain acid substances of the nature of tannin, which act upon litmus paper and consume the alkaline liquid just as potassium bitartrate would do. To obtain exact results it is therefore necessary to ignite the sample, and determine the potassium in the residue by means of a standard acid. The determination of calcium tartrate is often made by dissolving the sample of tartar in hydrochloric acid, and precipitating with caustic soda. This method gives satisfactory results if the specimen to be analysed is free from calcium sulphate. In the contrary case the numbers found are always erroneous, the error being proportionate to the quantity of gypsum present. It is known that calcium sulphate, in presence of an alkaline solution of a neutral tartrate, is converted into neutral calcium tartrate, whilst the alkaline base combines with the sulphuric acid. The reaction is so complete that in certain works it is used for the preparation of calcium tartrate for the formation of tartaric acid. At the moment when the hydrochloric solution of the tartar is neutralised, in order to precipitate the calcium tartrate, the most favourable conditions are obtained for the formation of this body at the expense of the calcium sulphate, and if there is gypsum in solution, as often happens, the quantity of calcium tartrate obtained by no means represents the amount actually present, but is augmented in equivalent proportions. Some authors have recommended the following process:—Calcination of the tartrate to be analysed, when the tartrates and bitartrates are converted into carbonates. The potassic carbonate is dissolved in water, and shows on titration the quantity of bitartrate originally present. The calcium carbonate remaining on the filter shows, in like manner, the value of the pre-existing calcium tartrate. But this process, though accurate when the tartar is free from gypsum, is otherwise defective. Hence the following method is to be preferred:—The sample is dissolved in hydrochloric acid, the filtered solution is neutralised with

caustic soda, and then precipitated with calcium chloride. All the tartaric acid is precipitated as calcium tartrate. The precipitate is washed, calcined, and the calcium carbonate obtained is titrated in the ordinary manner. If the tartar has been previously titrated with a standard alkaline liquid it is easy, from these two data, to calculate the respective quantities of potassium bitartrate and calcium tartrate; but this is only possible when the sample is free from other acid products.

On Normal Methyl-oxybutyric Acid and its Derivatives.—E. Duvillier.—This acid is a slightly oily liquid, soluble in water, alcohol, and ether, and has an acid and sweet taste, and a strong acid reaction. Its composition corresponds to the formula $C_5H_{10}O_3$.

On a New Mineral discovered by Mr. Lettsom.—M. Lecoq de Boisbaudran.—Mr. Lettsom, having formed a collection of English specimens of blende to be sent to the author for the detection of gallium, found that certain Cornish specimens in the Oxford collections were not blende at all, containing neither zinc nor sulphur, but were composed essentially of didymium and erbium phosphate. Mr. Lettsom has given this mineral the name of Rhabdophane. Its exact locality is not known.

Les Mondes, Revue Hebdomadaire des Sciences, No. 16, April 18, 1878.

The Fumivorous Furnace.—M. Dufour.—This new furnace is reported to be completely successful both in the prevention of smoke and in the economy of fuel. At Compiegne it was adapted to an ordinary boiler 7 metres in length. The evaporation without the "fumivore" was 4·16 litres of water per kilo. of fuel, whilst with the fumivore it rose to 12·11 litres.

No 17, April 25, 1878.

The salts of potassium, copper, cobalt, and magnesium are found by MM. Joliet and Lafont to be muscular poisonous, and to interfere with the movements of the heart. The salts of sodium do not share this property.

Reimann's Färber Zeitung, No. 16, 1878.

Alkalimetric Indicator.—W. v. Miller proposes the colour tropeolin, discovered by O. Witt, and manufactured by Williams, Thomas, and Dower, of Brentford, as an indicator for the presence of an acid in volumetric analysis. Yellow tropeolin (No OO) turns at once to a crimson red in an acid liquid. This indicator is especially adapted for the titration of soda-ash as it is not affected by carbonic acid, which consequently does not require to be expelled by boiling.

No. 17, 1878.

Anhydrous sulphuric acid is now manufactured on a commercial scale in Bohemia, and is sold in tin cases, which appear not to be attacked by the acid. It is chiefly used in the manufacture of artificial sulphuric acid.

Berichte der Deutschen Chemischen Gesellschaft, No. 4, March 11, 1878.

Oxidation of Aluminium.—Carl John.—The author finds that aluminium amalgamated with mercury, steeped in water acidulated with sulphuric acid, and then taken out and dried, becomes subsequently covered with a white coating of alumina, among which globules of mercury are perceptible.

On Mono-nitro-pyro-catechin.—Rudolf Benedikt.—This compound, $C_6H_3(NO)(OH_2)$, crystallises in minute needles, dissolves readily in water, alcohol, and ether, but sparingly in benzol. It fuses at 157°; at higher temperatures it is decomposed, burning with a sooty flame, and leaving much charcoal. It dissolves in potassa-lye with a splendid purple colour, a reaction so sensitive that it may serve as an excellent indicator in titrations.

MISCELLANEOUS.

The Institution of Civil Engineers.—The *Conversazione* of the President, Mr. J. F. Bateman, F.R.S., will be held on Monday, June 3, at the India Museum, South Kensington, by permission of the Secretary of State. The change from Tuesday to Monday has been made on account of the 3rd of June being the fiftieth anniversary of the grant of the Royal Charter of Incorporation, which will thus be appropriately celebrated. The party will be exclusively for gentlemen, as in the time when the gathering took place at the rooms of the Institution.

Mr. William Baker, of Sheffield.—In our issue of May 3 we referred to an alarming accident which had befallen Mr. Baker, and which it was feared must prove fatal. Our readers, especially those who know Mr. Baker, will be glad to hear that he is now making satisfactory progress towards recovery. The fracture of the skull has healed up, and, although he was at first totally blind, he can now see sufficiently well to make it probable that his sight will be restored. We trust that we may soon have the satisfaction of announcing that Mr. Baker has quite recovered. A long time must, however, elapse before he will be able to resume the duties of his profession.

MEETINGS FOR THE WEEK.

MONDAY, June 3rd.—Royal Geographical, 8 30.
— Royal Institution, 3. General Monthly Meeting.
TUESDAY, 4th.—Royal Institution, 3. "Minute and Low Forms of Life," Rev. W. H. Dallinger.
— Zoological, 8.30.
WEDNESDAY, 5th.—Geological, 8
— Microscopical, 8.
THURSDAY, 6th.—Royal Institution, 3. "On Molecular Physics: Gases," Prof. Guthrie.
— Royal 8.30.
— Royal Society Club, 6.30.
— Chemical, 8. "Analogies between the Action of the Copper-zinc Couple and Occluded and Nascent Hydrogen," Dr. Gladstone and Mr. Tribe. "On the Alkaloids of the Aconites," Part III., Dr. Wright and Mr. Luff. "On the Alkaloids of *Veratrum Sabadilla*," Dr. Wright and Mr. Luff. "On the Action of Hydrochloric Acid on a Variety of Compounds," J. W. Thomas. "The Action of Oxides on Salts," Dr. Mills and Mr. Wilson. "A New Test for Glycerin," A. Senier and A. J. G. Lowe. "Ammonium Tri-iodide," G. S. Johnson.
FRIDAY, 7th.—Royal Institution, 8, Weekly Meeting. "Romanticism," Mr. W. H. Pollock, 9.
— Geologists' Association, 8.
SATURDAY, 8th.—Royal Institution, 3. "On Joseph Addison," Prof. Henry Morley.
— Physical, 3.

TO CORRESPONDENTS.

Saccharine.—We have several letters waiting for you at our office. Please forward your present address.

Just completed, a few copies of

FARADAY'S EXPERIMENTAL RESEARCHES IN ELECTRICITY (1839-55), 3 vols., 8vo., with 16 plates, cloth, £2 8s.

Each volume sold separately for 21s.

This book is still the great text-book of Electricians, and will always remain the Master Key of the science. New discoveries may and will be made, but to Faraday's Researches the scientific world will always have to refer as to their *Magnum Opus*.

Copies have lately sold for seven and eight guineas: the above should therefore be secured at once before the price rises again.

BERNARD QUARITCH, 15, Piccadilly, London.

THE CHEMICAL NEWS.

VOL. XXXVII. No. 967.

COLOUR-COMPARATOR FOR QUANTITATIVE ANALYSES.

By Professor ALBERT R. LEEDS.

THERE are numerous chemical operations in which it is required to estimate the amounts of substances in solution by the relative depth of tint of a certain colour. Various methods of so doing have been resorted to, some involving considerable instrumental complication in the way of lenses, graduations, and rack and pinion movements. Without describing these more particularly here, it will be sufficient to say that the apparatus herein described was arranged with a view of dispensing with all lenses or with graduations which could not be executed by the chemist himself.

It was designed, moreover, to permit of the comparison of a large number of liquids at the same time and in the same vessels in which the various operations upon them had been originally performed.

It is a rack, about 16 inches wide, and of about the same height. The materials employed have been tin, sheet brass, or, in the latest and most perfect forms, of a combination of iron and brass castings. It is arranged to hold 10 comparison tubes, each of which, when filled to the same depth (6 inches), contain precisely 100 c.c. An adjustable mirror reflects the light downward, through these comparison tubes, and the light, after passing through slits ($\frac{3}{4}$ of an inch long and $\frac{1}{4}$ inch wide), cut in a stage beneath, is reflected outward to the eye by a similar adjustable mirror. In the apparatus figured the supports of the upper mirror are placed at the front corners, so as to make the axis of the mirror in front of the upper row of holes, and permit the tubes to be lowered into their places from the top. Later, it was found more convenient to slip the tubes in from below, which can be done without rising from one's seat, and in this case the axis of the mirror was put directly over the centres of the line of holes, and the mirror made somewhat narrower (3 inches). A black cloth, not shown, hung from the back upper corners, prevents any light reaching the eye except that reflected from the lower mirror.

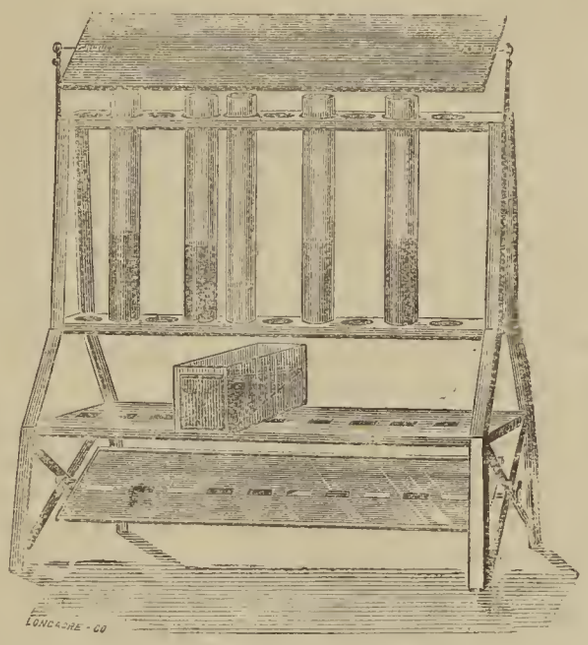
The comparison is effected by a prism nearly filled with a suitable coloured liquid. The prism is constructed by cementing within four straight walls of plate glass the inclined top and bottom sides of the prism. It is 10 inches long, $1\frac{1}{2}$ inches wide, $2\frac{3}{4}$ inches at the base of the prism, narrowing to $\frac{3}{10}$ inch at the apex. The prism is cut off in this manner at the apex, because when filled with liquid of the most suitable intensity of colour, the gradations beyond this point are too inconsiderable to be of value. The liquid is introduced through an orifice in the base, over which is afterwards cemented a glass cover.

It would be of great service if a little prism of about these dimensions were obtainable. This would permit of other than aqueous solutions being employed without detriment to the cement. And since it is desired to compare tints of colour only, slight irregularities in the thickness of the walls of the prism would not seriously interfere with its use. In making the comparison, the prisms may be either lifted to the right or left directly upon the stage, or placed upon a second movable stage, which rests upon the former and acts as a carriage. The prism is then moved out or in until the requisite shade of colour is arrived at. Considerable difficulty is also experienced in purchasing comparison tubes of uniform diameter, so that when equal amounts of liquid are introduced they will be filled to the same height. It is hoped that comparison tubes with flat bottoms can be moulded, which will prove satisfactory.

Employment of the Comparator in the Estimation of Ammonia.

Some difficulty was experienced in finding a comparison liquid, which would follow the tints given by the Nessler test, not only in very dilute, but also in more concentrated solutions of ammonia. It was found that neutral ferric chloride, potassium sulphocyanide, and nickel chloride, in proper proportions, gave identical tints, but the solutions decomposed on keeping. After many trials, in which the chlorides of gold and platinum and other salts were employed, with the admixture of colouring matters, and of similar mixtures with infusions of tea, coffee, &c., we finally succeeded in obtaining, with caramel solution and a small addition of aniline red, a satisfactory comparison liquid.

Method of Comparison.—Above the prism, in the comparator, a comparison tube with about 20 c.c. distilled water is placed. The comparison liquid is made of such strength that the light, after traversing its greatest depth in the prism, shall give a tint corresponding to 10 centi-



milligrammes of ammonia. An application scale is prepared once for all, by comparing the tints given by the prism with those given by known solutions of ammonia and the Nessler test, in 100 c.c. or 50 c.c. of distilled water placed in the comparison tubes. The readings are accurate within 0·005 milligramme of ammonia.

Quantitative Estimation of Colour in Potable Waters.

The method ordinarily employed is to fill cylinders of a certain diameter and depth with the same volumes of the waters under examination, and then by description terms to describe the tints as compared with one another and with distilled water. But as a general rule, these tints are not so far different from those which may be obtained by weak solutions of caramel, and these again from those imparted by the Nessler reagent to minute amounts of ammonia in solution, that a prism with a suitably arranged application scale may not be used in quantitatively estimating depth of tint in the colour comparator. Thus, on December 4th, 1877, the colour given by 100 c.c. of Passaic water in one of the comparison tubes more nearly corresponded to that communicated by the prism when shoved in to a point equivalent to 0·075 m.grm. ammonia than to any other point on the scale, and this figure might therefore be taken as expressing the tint of the water at that date.

If it were desirable to compare the tints of a large number of samples of water, and to express minute shades of colour, it would be desirable to fill a wedge with a correspondingly dilute solution and to graduate it by comparison with correspondingly minute amounts of ammonia.

Alkalinity or Acidity of Potable Waters.

The colour-comparator may likewise be employed advantageously to make a quantitative estimation of the degree of alkalinity or acidity of potable waters. This point in the analysis of drinking-waters does not appear to have attracted much attention, probably because these waters are, as a general rule, so nearly neutral that they do not react, alkaline or acid, with the tests in general use. In the *American Chemist* for March, 1874, I have called attention to the great sensitiveness of an alcoholic solution of alizarin in this respect, and proposed to employ it as a means of comparing the alkalinity of drinking-waters obtained from various sources. This may be done very rapidly by means of the colour-comparator. One comparison-tube is filled to the 100 c.c. mark with the water to be tested, and a second with water re-distilled until it has ceased to give any reaction for ammonia. 5 drops of alizarin solution are added to each, and then a centinormal soda solution run in, if, as is generally the case, the water reacts alkaline, until the liquid in both tubes has precisely the same tinge of red colour. The amount of alkali added may be taken as an index of the total alkalinity communicated by the various saline bodies held in solution. Thus, on April 30th, 100 c.c. of the Passaic water, as drawn from the laboratory hydrant, acquired the same tint, when alizarin was added to it until the colour no longer deepened, as 100 c.c. pure water to which the same amount of alizarin and 0·00068 grm. soda had been added. Of ordinary distilled water, c.c. was equivalent to 0·0003 grm. soda. This is not very far different from the amount which would be equivalent to the ammonia contained in ordinary distilled water, as determined by the Nessler reagent.

An attempt was made to substitute a solution of phenol-phthalein for alizarin in these estimations. But there was no perceptible reddening when phenol-phthalein, in amounts considerably greater than those which would correspond to the alizarin employed above, was added to similar samples. Phenol-phthalein is far less sensitive than alizarin, and for such purposes is inapplicable. In titrating with alkali, however, it has an advantage over alizarin in the following respect:—The latter changes very gradually through various shades of yellow-red to a red of different degrees of intensity. The red tint imparted by alizarin, therefore, does not mark the end reaction very satisfactorily, and it is safer to titrate back with acid until the red tint has disappeared. With phenol-phthalein the transition from a colourless solution, when a normal soda solution is added, to red is abrupt and positive. It is rather a matter of surprise to me that alizarin as an indicator in titrations, and for test-paper, has not come into general use: in this laboratory it has been in constant employment for the past three years.

Estimation of Combined Carbon in Iron and Steel with the Colour-Comparator.

It is well known that when iron and steel are dissolved in nitric acid the solution acquires a colour which is more or less brown in proportion to the amount of combined carbon present, and that a very ingenious method of carbon determinations was based by Eggertz upon this property. He obtained a standard tint by the solution of a sample containing a known amount of carbon, from which, by comparison of the depth of colouration, the percentages of carbon in other samples could be estimated.

His process has been variously modified, more especially by the substitution of a number of standard solutions, corresponding to various carbon percentages, in place of the one standard solution.* In this case, as the solution of the metal in acid does not preserve its tint for any length of time, the standard solutions are usually made of some colouring matter like caramel. A number of test-tubes are arranged in a convenient rack, and filled with solutions, beginning with a colour corresponding exactly with that produced by the solution of 1 grm. of iron containing 0·02 per cent of combined carbon in 15 c.c. of nitric acid of specific gravity 1·20, and ending with a colour corresponding to a similar iron dissolved in like manner, but containing 0·30 per cent of combined carbon.

Instead of a series of separate tubes, varying in colour by an amount corresponding to 0·02 per cent of carbon, it is proposed to use a prism filled with solution of caramel, or, as Britton has proposed, with a solution obtained by digesting roasted coffee in dilute spirit, and of such strength as will represent every percentage between the points most frequently to be determined. A 1 grm. of wrought-iron or steel, in which the percentage of combined carbon has previously been determined with great accuracy, is digested with 15 c.c. dilute nitric acid at 80° for half an hour. The residue is gently heated over a lamp with 5 c.c. fresh acid, the solution added to the main portion, and filtered through a small asbestos filter. From the filtrate a series of solutions is prepared, each reaching to the 50 c.c. mark in the comparison-tubes, and each exactly half the strength as the one preceding. These tubes are then placed in the comparator, and the points on the prism which transmit identical tints of colour are carefully noted, and transferred to an application-scale. 1 grm. of the sample to be analysed is dissolved in like manner, the filtrate made up to 50 c.c. in the comparison-tube, and then the prism is moved out or in until it gives the same tint of colour. The percentage, as marked on the application-scale corresponding to this point, is the percentage of combined carbon in the sample under analysis. If the percentage of carbon in the sample exceeds that indicated by the prism, a correspondingly less amount of the sample is to be brought into solution.

To illustrate the method the following details are given:—A prism 10 inches long, with a suitable caramel solution, was provided in the manner stated with an application-scale graduated from 0·00 to 0·24 per cent carbon. Upon a scale of this length, the intermediate percentages could readily be obtained by interpolation. The graduation was not carried higher than 0·24 per cent, because larger amounts of combined carbon gave tints of colour too deep to allow of slight differences in tint being recognised by the eye with certainty. A direct comparison with a series of steels, in which the amount of total carbon (column II.) had been determined by combustion, gave the following results (column I.):—

		Column I.	Column II.
Sample	I.	0·09	0·302
,,	II.	0·46	0·490
,,	III.	0·44	0·529
,,	IV.	0·62	0·649
,,	V.	0·72	0·801
,,	VI.	0·76	0·841
,,	VII.	0·80	0·867
,,	VIII.	0·86	0·870
,,	IX.	0·92	0·955
,,	X.	0·96	1·005
,,	XI.	1·04	1·058
,,	XII.	1·12	1·079

Without attempting to explain the discrepancies between these figures, the number of correspondences was thought sufficient to warrant the publication of the method, and to give the hope that with further trial it might prove rapid and accurate within the required limits. My thanks are due to my assistant, Dr. G. A. Prochazka, for his aid in making the foregoing determinations.

Stevens Institute of Technology, Hoboken, U.S.

* J. Blodget Britton, *Journ. Franklin Inst.*, [3], vol. lix., p. 356.

A STUDY OF PLAT-AMMONIA COMPOUNDS.

By SAMUEL E. PHILLIPS.

II.

IF the cuprammoniums, the palladammoniums, and others, are first of all—

$$RH_3N,Cl,$$
then $RH_6N_2,Cl,$
or $RH_{12}N_4,Cl,$

with tri, penta, or other condensations, and with other normal and hybrid variations, then we may have succeeded in reducing the platinum series to one ordinary group, where pedantic classificatory divisions are not desirable in sight of the great *tout ensemble* of chemical philosophy so much desiderated.

In concluding a second attempt to that end, the reiteration has now been prompted by three collateral considerations which seem to fairly stand in close relation thereto :—

First. We have seen that with a certain or equivalent weight of platinum, varied or doubled only in the fifth series, ammoniacal condensations of 2N with 2Cl, 4N with 4Cl, and 8N with 8Cl, as alleged, precisely similar to the corresponding condensations of morphia and codeia, as embodied in the extended researches of Dr. Wright and others. If our resolution into the order and simplicity of law be valid in one case, may it apply equally to the other?

Secondly. We have seen a new series of plato-nitrates produced by the eminent and persevering labours of M. Nilson, and for which he has followed a fashionable routine in inventing new radicals for their interpretation. Again we say, may the same old principles and the same applications of electro law avail to the superseding of hypothetic radicals, for which there is no warrant either in sound theory or observed facts?

Thirdly. If the palladium analogues are found to conform with and to confirm the interpretation given of the platinum series, it might be well to glance at the general bearing, and reciprocal confirmation of all metal ammoniums generally.

In "A Study of Condensation Radicals" (CHEMICAL NEWS, vol. xxxi., p. 47) I endeavoured to reiterate and further exemplify the law of amine condensation; that they were one, and like all other condensed radicals; that while popular error believed in H_4N, H_8N_2, $H_{12}N_3$, &c., that both law and fact necessitated the progression H_4N, H_7N_2, $H_{10}N_3$, &c.; and my chief object was an earnest enquiry in regard to some few exceptions, and notably the morphia and codeia condensations of Dr. Wright, of which an extreme case might thus be contrasted :—

	Ordinary Octamine.	Dr. Wright.
Chloride ..	$H_{25}N_8,Cl$	$H_{32}N_8,Cl_8$
Acetate ..	$H_{25}N_8,O.AcO$	$H_{32}N_8,O_8.8AcO.$

Dr. Wright most kindly and genially defended his research, nor did I consider it fair or respectful to rush on a platform of equality with one so eminently superior in position and attainments; but it is important to note that he considered his interpretations as not exceptional, but justified by both law and fact, urging that "As a rule the maximum combining power of such bodies is normally equal to the number of N symbols in their rational formulæ; though a lesser acid combining power may be sometimes manifested, &c. The only poly-ethylen tetramines exhibit a maximum acid combining power of four, and so on."

In CHEM. NEWS (vol. xxxii., p. 1), "On the Mono-character of the Ethylen and other Poly-amines," I endeavoured to show that all such bodies were normally mon-acid; urging that "this really is not a question of what may be, but of what the facts are, as derived from modern authorities holding the same views with Dr. Wright."

With declining powers I cannot hope to entertain any adequate investigation of those elaborate researches, extending to more than twenty memoirs, submitted to the Royal Society.

In the earlier stages the idea was that codeia was methyl morphia—

$$\underset{\text{Codeia.}}{C_{36}H_{21}O_6N} + HI - MeI = \underset{\text{Morphia.}}{C_{34}H_{19}O_6N},$$

but that practically morphia could not then be so obtained, as there was a tendency to assimilate 2H giving hydromorphia, $C_{34}H_{21}O_6N = X$, and that this was the subject of polymerisation.

Of these we select two typical cases, as illustrative of many others, with hydro-codeia and hydro-deoxymorphia, &c. :—

(A) is produced by 4X+6HI, and is represented as containing—

$$C_{136}H_{86}I_2O_{24}N_4.4HI.$$

As a normal *iodide* the elements would be thus :—

$$C_{136}H_{94}O_{24}N,HI - = 5I.$$

(B) is produced by 4X+7HI+20HO, &c. The idea being that these bases, acted upon with HI, indicate that they are "unsaturated" bodies, and capable of taking up several molecules of HO and HI; generally two equivalents for one of N.

This is substantially my own view of the case :—As quinon absorbs 2H, and becomes hydro-quinon, so it may under certain conditions pass through other stages up to the point of paraffin saturation, $C_{12}H_3$, $C_{12}H_5$, $C_{12}H_7$, $C_{12}H_9$, $C_{12}H_{11}$, and $C_{12}H_{13}$. And in the mechanism of these reactions with HI, it often happens that HH are replaced by HI.

In many cases this action takes place almost spontaneously; in others, it may require more exciting conditions; and it is also well known that the same conditions very often tend to a polymerisation of the radical.

The only difference between us is as to the *à priori* feeling in the distribution of these hydrations where substitutional ammonias are concerned.

Dr. Wright has a *hard and fast* rule, by which the outsiders follow the number of N equivalents, putting the rest in the radical or ammonium. I see no evidence whatever for that hypothesis, but am far from supposing a similar regularity of mono-appropriation, as suggested in *the normal iodide* above. On the contrary, I maintain that 2HCl, 2HBr, &c., very often represent the ordinary 2HO of a hydrate; and it may surprise some when I have completed the evidence for a new extension of hydrate law, as outside or apart from the radical oxide or iodide.

It is amusing to see Dr. Wright modestly hesitating—at one time wondering whether they be definite compounds or mere mixtures; at another time deploring the non-agreement of repeated analysis; and often finding amorphous tarry products, rather than definite crystals; yet, throughout all, endeavouring to apply the one *hard and fast* hypothetic rule. No botanist would waste his time in such bewilderment with hybrids; and in lieu of his lax method of appreciating free bases from the tetra- and other poly-iodhydrates, I would, for my part, only be satisfied with definite saltic derivatives.

Subsequent researches tend more and more to a doubling all the preceding notations. The hydrochlorate of tetra-codeia is a brownish brittle tar, and is of course an 8HCl body!

The action of HCl on the tri-codeia gives another body −12HO, that is −2HO for every single codeia; and the many facts in this direction point irresistibly to the idea of weakly saltic dedoublements, such as we have referred to in the fifth series of platinum compounds :—

Morphia −2HO = apo-morphia
Morphia +2H = hydro-morphia.

Then we have oxy-morphia, deoxy-morphia, and other modifications of the type; and if we add to these chloro- and iodo-varieties of these several types, it becomes extremely feasible that under the forced conditions they should combine together, in weakly saltic dedoublements, to produce the supposed hexa- and octa-bodies under consideration.

In reply to S. E. Phillips, Dr. Wright cites the following proofs that morphia and codeia are 2N bodies :—

$C_{34}H_{37}ClN_2O_6$
$C_{34}H_{37}AcN_2O_6$
$C_{34}H_{36}BuAcN_2O_6$
$C_{36}H_{43}ClN_2O_6$.

But these prove nothing beyond the fact that all bodies may have their di-forms, and thus it is that Watts, on giving a list of oxy-morphia derivatives, ends with two hydrates :—

The mono- $= C_{34}H_{20}O_8NO.HO$
The di- $= C_{68}H_{39}O_{16}N_2O.HO$.

Of course they are notated very differently, but they have these normal elements, and their real purport is quite plain.

The di-acetyl, di-butyryl, and di-benzoyl derivatives of codeia and morphia, unite with 2 atoms of EI, mostly forming definite crystalline compounds, and, for aught that is known to the contrary, they may do so precisely as narceine and cotarnine do, and this mono-view is that which is most generally entertained.

It is easy to sit in judgment on profound researches; estimating things from another point of view, and judging superficially, to find fault; but whoever has time and ability to fairly appreciate must find a monument of labour, skill, and perseverance which goes far to redeem this country from the reproach of backwardness in original research.

But, with all the promptings of high admiration, I cannot estimate my point of view as *superficial*, and if similar tetra and octamin developments can be reduced to the simplicity of ordinary and mono-laws of combination, it does seem likely that a similar result may here also take place.

The Plato-nitrates.

M. Nilson, discarding the old view of these being double nitrites of Pt and other bases, evinces a lively fertility in the invention of new radicals on di- and tetratomic lines of construction; but he is little aware that old views may admit of a youthful renovation, and that, animated by the accessions of modern knowledge, they do not require the ordinary laws of combination to be overlaid by wanton hypothesis.

That the ammonium type is *one*, embracing nitric acid as one extreme, and ammonium in the other, is a modern fact, and triumph for old views, which will not be admitted until the underlying facts of atomicity can receive a better explanation than that ordinarily afforded.

Between O=8 and H or Cl, as between sodium and barium, there are differences of a marked character, which diatomic philosophy is incompetent to explain; nor can I feel any triumph therein, but must confess to a reluctant ignorance; but those who are freest from hypothesis may be expected to discern with more of simplicity the onward revelations of truth and new facts.

It is thus I would lay stress on the applications we have made of Pt replacing one H in ammonia; and our object is now to urge that the same may be said of O=8 or S=16!

The odd and even ratios of O and H are very curious and instructive. Of NO or NH I know nothing as combining radicals, and of imide substitutions I am utterly sceptical.

NO_2 and NH_2 are both good and well known radicals of H equivalence, as seen in many nitroso or amido substitutions.

NO_3 and NH_3 are in no sense radicals; one is the nitroso-oxide of the nitrites, as the other is a hydride of amidogen, and possessing characters in common with all other hydrides.

NO_4 and NH_4 are definite and well known radicals, one of nitric acid the other of ammonium compounds, and both otherwise replacing H' in many and well-known ways.

Nor is this all; for between the two extremes there subsists every possible intermediate transition, not as exceptional facts, but fully paralleled in the analogous phosphines, arsines, and other ammonia types.

We have— PtH_3N
PtH_6N_2

Then why not— PtO_3N
PtO_6N_2

Suffice it to say that M. Nilson's extended series of plato-nitrates have exactly the elements thus pre-indicated—

$KO.PtO_6N_2O$

Of this series, the salts analysed have the very widest range, including all the cerite metals, as protoxide bases, and the sesqui-salts are equally normal in having 3 atoms of acid. They comprise a wide range like the corresponding sulphates—

$Al_2O_3.3SO_3$
$Al_2O_3.3PtO_6N_2O$, &c.

Of the General Character of the Metal Ammoniums.

On this occasion we only initiate a general review of these compounds, taking note of their more salient characteristics; and taking them in electro order, commencing with the most negative—

(1.) Gold is generally considered tri-atomic. Of its oxides and chlorides, we may have the proto- and di-forms, but it is most normally tri, *in relation to* O *or* Cl, and what alone concerns us in this connection is the undoubted fact of its mono-replacement of H.

HH_3N,Cl
AuH_3N,Cl
AuH_6N_2,Cl, &c.

(2.) and (3.) Of platinum and palladium, which are mono in the platinites, but most normally di in the platinates and palladiates we have the same mono-equivalence in substitution.

In treating of these, we omitted an important reference. It is alleged that "PtCl—called platinum dichloride ($Pt''Cl_2$)—absorbs 2 molecules of ammonia, forming platosammonia compounds ($N_2H_6Pt''Cl_2$); and $PtCl_2$—called platinum tetra-chloride ($Pt'''Cl_4$)—absorbs four molecules of ammonia forming platin-ammonia chloride ($N_4H_{12}Pt''''Cl_4$)."

That this is a deceptive expression of hypothesis, and *not of facts*, we hope to have made plain in the exceptional and *forced* conditions by which alone, the so-called platinamin or bichloride series can be produced.

It is a fact that both chlorides give *normal* results with ammonia, and that *both* when heated with excess of chlorine gas or strong nitric acid also give the abnormal bichloride or oxychloride derivatives.

(4.) Mercury, like platinum, has an extensive series of metal ammoniums, which may be studied under two aspects :—First. That of agreement with all the preceding, by which we have—

HH_3N,Cl,
HgH_3N,Cl,
HgH_6N_2,Cl, &c.

Secondly. A considerable range of discrepant combinations, which are outside our present limits, and which well demand a new and separate investigation. Our present *à priori* conviction being that, in common with copper, both elements are subject to allotropic variations of mono- and di-atomic weight, a principle exemplified in both mineral and organic chemistry.

(5.) and (6.) Ruthenium and iridium are both mono- and

di-atomic, and in so far conform to the platinic types; but that they are lower in the series, or less negative, is seen in this: that whereas Pt is very rarely sesqui, yet that intermediate type is much more predominant with these two metals, and they faintly introduce us to a new series of metal ammoniums, such as are predominant with the lower sesqui metals. Ruthenium gives some well-marked yellow salts of—

$$RhH_3N,Cl$$
$$RhH_6N_2,Cl,$$

both of which have been studied in their carbonates, nitrates, sulphates, and other good crystalline salts.

The deep golden-yellow diamine salts give off ammonia, and leave the lighter yellow salts of the simpler type. But the transition is best seen with iridium, which forms two distinct series. Like platinum we have—

$$IrH_3N,Cl,$$
$$IrH_6N,Cl, \&c.$$

With the corresponding sulphates, nitrates, &c., and a "nitrato-chloride" analogous to Gros's Pt salt, obtained by treating the chloride with strong nitric acid!

Like cobalt we have $(Ir_2Cl_2)H_{15}N_5,Cl$, of which the carbonate, nitrate, sulphate, and other salts have been prepared.

(7.) *Rhodium.*—The normal platinates are $KCl.PtCl_2$. The normal rhodiates, like many iridiates, $=3KCl.Rh_2Cl_3$; and hence the correspondence in the "ammonia rhodiums,"

$$[N_6H_{14}Rh_2'''(NH_4)_4]^{VI}.Cl_6 = (Rh_2Cl_2)H_{15}N_5,Cl.$$
$$(Rh_2O_2)H_{15}N_5,O.$$

The latter is a strong base, giving sulphate, oxalate, nitrate, and other crystalline salts; there is also a triamine form, and doubtless may be many others,—

$$(Rh_2Cl_2)H_9N_3,Cl.$$

(8.) *Chromium.*—The corresponding chromium-ammonia salts have heen extensively produced in oxy, chloro, bromo, and iodo forms, and the tendency is apparently to tetramin bases:—

We have a bromide thus	$(Cr_2Cl_2)H_{12}N_4,Br$
A chloride	$(Cr_2Cl_2)H_{12}N_4,Cl$
A diamine nitrate	$(Cr_2O_2)H_6N_2,O.NO_5$
A mono-oxalate	$(Cr_2O_2)H_3N,O.C_2O_3$,

and others.

(9.) *Cobalt.*—It is here we have the fullest development of these metal ammoniums, and the varied interpretations they have received are at once both amusing and pitiable. As the platinum types—at any rate in their greatest simplicity—extend more or less to all metals, down to copper, zinc, and potassium, so cobalt is not excluded from that series. As such we have—

$$CoH_3N,Cl$$
$$CoH_6N_2,Cl$$
$$CoH_6N_2,O.SO_3$$
$$CoH_9N_3,O.NO_5, \&c.$$

These are formed when cobaltous salts are treated with varying proportions of ammonia and *protected from the air.* But they are easily oxidised, and thus give rise to what are called "peroxidised ammonia-cobalt salts," which are thus epitomised by Watts:—

Tetrammonia-cobaltic-chloride ..	$Co_2Cl_6.4NH_3$
Hexa-ammonia-cobaltic chloride ..	$Co_2Cl_6.6NH_3$
Octo- ditto ditto ditto (fusco)	$Co_2Cl_6.8NH_3$
Deca- ditto (reseo and purpureo)	$Co_2Cl_6.10NH_3$
Dodeca- ditto ditto ditto (luteo)	$Co_2Cl_6.12NH_3$

We hope to have refuted the hypothesis that in platammoniums, as in other ammoniums generally, the number of N equivalents determines the number of acid saltic constituents; but, strange to say, here is *another* hypothesis which totally misunderstands the oxy or chloro function in these sesqui compounds, representing the 6 atoms of chlorine as apart from the radical, and capable of replacement by so many atoms of acid!

On the contrary, we know that these sesqui bases can be well traced in their simple saltic forms, as also in their ammonia replacements, by 1 H. In the former, cobalt and uranium are most normally mon-acid, but have other variations,—

$$(U_2O_2)O\,SO_3,$$
$$(Co_2O_2)O.SO_3, \&c.,$$

whereas other sesqui bases are most normally tri-acid, as in—

$$(Al_2O_2)O.3SO_3,$$
$$(Fe_2O_2)O.3SO_3, \&c.$$

A similar range of mono-, di-, and tri-acid behaviour seems to extend to the ammonia condensations where these sesqui-radicals replace 1 H: but whether due to any inherent tendency in the ammonia base or to the mechanism of production is not yet at all clearly understood.

It would not comport with the extreme brevity of this short notice to enlarge on the very extended cobalt series; suffice it to say that they appear to have three principal forms:—

(1.) The simple type corresponding with all other metal ammonias, from gold to potassium, CoH_3N,Cl, &c.

(2.) The sesqui types corresponding with those of iridium and chromium, $(Co_2O_2)H_9N_3,Cl$, &c.

(3.) A new series of "oxy-cobalt ammonias" studied by M. Fremy. As these differ from the second series by the uniform addition of O′ or Cl′, the inference is irresistible that they correspond to the platinum series of bichlorides or oxychlorides.

NOTE ON UREA AND CRENATE OF AMMONIA IN SPRING WATERS.

By Dr. T. L. PHIPSON, F.C.S., &c.

The method by which urea can be discovered in the canal waters of Rotterdam and other places, has been also applied by me, in some instances, to detect crenic acid. I have found, in fact, that this method is liable to be interfered with, unless urea is present in considerable quantities, by the presence of crenate of ammonia, and that it can also be used to isolate crenate of ammonia in some waters which contain that substance in notable quantity and no urea.

It consists in evaporating about a quart of the water at a moderate temperature, making use of a water-bath, and treating the dry residue with absolute alcohol. The alcoholic solution being likewise evaporated to the state of a thick syrup, a minute quantity of this is placed upon the glass slide of the microscope with a drop or two of strong nitric acid. As soon as the liquid has been dried up by the aid of moderate warmth, the slide is examined with a low power, when the crystals of nitrate of urea (if urea is present) are easily distinguished. Occasionally they can be detected with the naked eye. This was the case with some water from the Knightsbridge Barracks, examined by me several years ago, of which one quart gave about 2 drachms of a yellow liquid having all the characters of urine.

In applying this method again recently to a well-water at Roehampton, in the county of Surrey, the alcoholic solution consisted entirely of crenate of ammonia. This water gave 35 grs. of solid matter (at 100° C.) per imperial gallon, composed as follows:—

Sulphate of lime	4·13
Carbonate of lime	11·20
Silica	1·47
Peroxide of iron and alumina	0·70
Chloride of magnesium	6·30
Sulphate of soda, with traces of potash	4·20
Phosphoric acid	none
Crenate of ammonia	2·85
Combined water at 100° C., organic matters insoluble in alcohol, traces of nitric acid, and loss	4·15
Total grains	35·00

One quart only of this water was evaporated upon a water-bath, and the residue, treated with absolute alcohol, gave a bright yellow solution of crenate of ammonia. Upon the evaporation of the alcohol the compound was obtained as a yellow amorphous mass, yielding a solution in water from which crenate of copper was precipitated. The compound which dissolves in the alcohol appears to contain an excess of crenic acid; for, whilst giving all the characters of this substance and of ammonia, it reacts acid to litmus. Doubtless the neutral crenate loses ammonia during the evaporation of the water, and this volatilised ammonia will be included in the 4·15 grs., part of which represents loss. No other organic substance could be detected in the alcoholic solution.

London, May 31, 1878.

NOTICES OF BOOKS.

Industrial Chemistry. A Manual for Use in Technical Colleges and Schools, and for Manufacturers, &c. Based upon a translation (partly by Dr. T. D. BARRY) of Stohmann and Engler's German Edition of Payen's "Précis de Chimie Industrielle." Edited throughout and supplemented with chapters on the Chemistry of the Metals, &c., by B. H. PAUL, Ph.D. London: Longmans and Co. 1878.

THIS book, in spite of the imposing array of names on its title-page, some of which are well and honourably known in industrial literature, is an additional example of the hopelessness of trying to compress an overwhelming amount of information into a comparatively small compass. The work before us is a very unequal production, much of it being from the hand of a master thoroughly acquainted with his subject, the rest from one who has evidently undertaken a task which was far beyond his powers. Messrs. Paul and Barry's production is at once too large and too small, too copious and too meagre, so that a book which ought otherwise to have proved of the greatest service to the technological student and worker has had its usefulness considerably reduced by defects that might have been avoided with a moderate amount of foresight and consideration. Both the German and English translators and editors have erred in adhering too rigidly to the plan laid down by the original author. The late M. Payen tried to teach too much, and Messrs. Paul and Barry have unfortunately not only followed his example, but gone beyond it. In certain parts of the work, too, there is an apparent want of acquaintance with the progress made by industrial chemistry in this country during the last ten years, which notably lessens the worth of an otherwise valuable and well-written manual. These are grave accusations to bring against a work which has been published under such excellent auspices, but be it said with regret that these charges can be only too easily substantiated.

The origin of the book has already been stated. It is called "Industrial Chemistry," and we are told that it is intended to be used by chemical students in technical colleges and schools, and manufacturers, &c. Judging from the fifth edition of the late M. Payen's "Précis de Chimie Industrielle," upon which Messrs. Stohmann and Engler's translation is founded, he seems to have had the notion of teaching his readers the general principles of theoretical chemistry and their application to the industrial arts simultaneously. A little reflection will show that in the present day such an idea is impracticable, for a student or manufacturer taking up the subject of chemistry applied to the arts would most certainly have already mastered so much of the science as to be beyond the need of elementary instruction in such subjects as the difference between chemical and physical action, specific gravity, combining proportions, chemical nomenclature and notation, quantivalence, and the doctrine of types. If he has not acquired this knowledge he is wholly unfit to study the practical part of the science. In adopting this method Messrs. Paul and Barry have gone far beyond their predecessors, and at the very commencement of their work they give fourteen valuable pages on the mere rudiments of chemistry. At the beginning of every article, too, a large amount of space is taken up with details respecting the discovery, history, and properties of the element or compound under consideration. Methods of production and the properties of substances are described that have no possible connection with chemical manufactures. Such particulars as these are no doubt valuable and interesting, but they are out of place in the present instance. What would be said of the author of a treatise on book-keeping, let us say, who began by instructing his students in spelling or the multiplication-table, or a writer on conic sections who loaded his book with instructions for the solution of simple equations or the extraction of the square root? Not only is the book overburdened with explanations of the most elementary chemical principles, but it is also crowded with descriptions of elements and compounds which at present, at any rate, have not the remotest chance of being made available for industrial purposes. It may be objected that the unique laboratory curiosity of to-day flows into our markets in tons to-morrow; but the copious details given about such rare elements as Se, Te, Ti, Mo, Nb, Di, and a dozen others, might surely have been left out until they had manifested their intention of trying to be of some service to mankind, as well as of allowing themselves to be found in somewhat greater profusion than at present. The natural consequence of this redundancy is, that there is no room left for a host of important details relating to the real subject of the book—Industrial Chemistry. Of such omissions it is easy to collect enough to fill several columns of the CHEMICAL NEWS, a few of them being of such a nature that we hunted through the book from title-page to imprint to see if there was not some promise of a second part or volume. If the most superficial of the frequenters of the Royal Institution were asked to mention the most prominent discovery that was made in industrial chemistry during the last twenty years, he would unhesitatingly mention the coal-tar dyes, and yet only the barest possible allusions have been made to them throughout the whole book. We have long-winded descriptions of Ro, Ru, Ir, Os, and Gl, but such important substances as benzol, anthracen, naphthalin, aniline, in fact nearly the whole of the derivatives of coal-tar, are merely glanced at.

We can hardly turn to a single section of the book without finding some specimens of this unnecessary copiousness, and still more disappointing meagreness. The very first operation that is described under the head of Oxygen is the method of making that gas by heating mercuric oxide—a mode of preparation which is never resorted to except as a lecture illustration. The principal methods of preparing the gas on the industrial scale are then hastily described, and the rest of the space is taken up with the history of the compounds of oxygen, which is quite out of place. To this succeeds an equally superfluous account of the principles of combustion, which the student ought already to have at his fingers' ends. A solution of hydroxyl is now extensively used as a bleaching agent for both live and dead human hair; but a perfumer turning to the method of preparing this compound would find full directions for making it by adding dilute acid to potassium or barium peroxide, but not the slightest clue is given to him as to how he is to obtain the last-named compounds.

Coming to the important subject of Water, we are given analyses of the water of the Möll, near Heiligenblut; of the Oetz, near Vent; of the Gergogne and of the Thé-

rouenne, wherever they may be; but there is nothing about the Trent, the Tyne, the Severn, or the Avon.

The important subject of Filtration is dismissed in half a page, the most modern filtering appliance—for instance, Bischof's spongy iron filters—not even being mentioned.

Passing on to Nitric Acid, we seem to have taken up another book, the article on that important compound being full and clear, and well illustrated with M. Payen's excellent cuts.

Under Ammonia, although the method of liquefying that gas is briefly described, the use of the liquid gas in Carré's ice-making machine is passed over in silence,—a remark which applies with equal force to liquid sulphuric dioxide, which has been so successfully used as a refrigerating agent by M. Pictet, Prof. Gamgee, and others.

Under Sulphur we have excellent descriptions of the method of manufacturing sulphuric acid from pyrites, full of interesting and valuable details. They are well illustrated by numerous cuts, but we miss the beautiful copperplates in the French and German editions, which have been replaced by small wood engravings which are not always too well executed. The account of the Sicilian method of sulphur-refining is well written. Throughout the whole of this article we seem to be under totally different guidance.

The account given of the manufacture and applications of carbon disulphide is equally full and interesting, but why waste so much valuable space in wearying the reader with twice-told tales about famous diamonds and diamond-cutting, leaving the student to search in vain for th method of making battery and electric light carbons?

The manufacture of matches is fairly well treated of under Phosphorus, and under Chlorine Weldon's process is well described.

Under Iodine, English methods of obtaining this important element are—with the exception of Pattinson's—taken no notice of, while several foreign processes are given: in fact we may make the remark, once for all, that throughout the book the translators seem to have pretty constantly ignored the claims of British inventors and manufacturers on their attention.

The section on Fuel is one of the best in the book.

The article on Gunpowder and kindred explosives is open to the two faults we have already had occasion to find so frequently. Not a word is said about pebble powder or on Abel's classical researches on gun-cotton and its congeners. A couple of lines are given to dynamite, and Horsley's and Brian's blasting-powders and lithofracteur are omitted, nearly a page being wasted on M. Payen's favourite explosive, pyroxam. The explosive properties of the picrates are not even mentioned, and mercury and silver fulminates are not to be found at all.

Glass, pottery, zinc, lead, copper, iron (an excellent article), and most of the industrial metals are well described, although the information—especially in the case of nickel—is not always brought down to the latest date. Not a word, for instance, is said about the New Caledonian nickeliferous ores and the ingenious method of extracting the metal from them invented by M. Garnier.

The organic portion of the book is particularly incomplete. The article on Paper opens with a ludicrous blunder; the German phrase *Surrogate für die Lumpen* (substitute for rags) is translated by the English word Surrogate, so that rag substitutes figure throughout as Deputies of the Divorce Court! A detailed account of the various German, Belgian, and French methods of making paper from such rag substitues as straw and wood is given, but our own country is only once mentioned, and that in connection with Bryan Donkin's spherical boiler; and one of our most important raw materials, esparto grass, is not even alluded to. The same ignoring of English processes is to be met with in the part treating of oils and fats, a dozen lines being given to Gossage's silicated soap, and three to Wilson and Gwynne's processes for saponifying fats for candle-making. We should have been glad, too, to have heard a little more about ozokerite paraffin.

The article on Gas and its manufacture, and gas-testing, is in company with that on Iron, one of the best in the book. The same praise may be extended to those on Sugar and India-rubber. Kamptulicon, and other manufactures of a similar nature, being purely English, are entirely passed over.

Under Wines, the method of detecting the presence of false colouring-matter—such as elder-berry juice, logwood, and some half-dozen others—is given; but rosaniline, which is now one of the most common, is left out, although mentioned as particularly dangerous.

Although containing a large amount of useful information, well condensed, the work is greatly lessened in importance by having been, so to speak, built on an utterly wrong system. First of all, it seems to have been a pity that the English edition should have been retranslated from the German when the original already existed in French. Had this not been done much of the clumsiness of style which is frequently apparent would have been avoided, and we should not so frequently be puzzled by obscure passages. A goodly number of misprints crop up here and there, such as Malagutti, Böttcher, pyroxilin, similior, and nitrihydride for nitric anhydride. Some of them, too, are particularly puzzling. In one place, for example, we are told that distilled sea-water is aërated by being *heated* in a drum through which a stream of air is constantly passing: on referring to the original we find that the water is to be beaten (*gepeitscht*) and not heated. The Index, too, is too small for a work of these dimensions, such important words, for instance, as Oxalic Acid, Oxalàtes, Picric, and Carbolic Acid, and numberless others, being omitted. In the German and French editions the text is illustrated by a series of nearly sixty very beautifully engraved copperplates, but for some unknown reason they are replaced in the English issue by woodcuts, which, though fairly executed, cannot for a moment be compared to the original, either for clearness or size. Some of the originals—the larger plates illustrating the sulphuric acid manufacture, for instance—are sufficiently detailed to form the basis of working drawings.

Comparing the bulk of Messrs. Paul and Barry's book with that of the original, we find that they have added at least half as much again to the text, and have nearly doubled the number of cuts. In form and typography the work closely resembles "Watts's Chemical Dictionary," and is well and clearly printed—a desideratum in a book of this class. Another peculiarity of the book is the almost entire absence of any references to authorities. Surely if the want of space compelled the authors to cut down their account of so important an explosive as dynamite, they might at least have referred us to a more detailed description of it in some other work.

Common Sense for Gas Users; a Catechism of Gas Lighting. By R. Wilson, C.E. London: Crosby Lockwood and Co.

The title of this little work might, at the first glance, be supposed to convey the insinuation that those persons only who are deficient in the somewhat rare quality styled common sense are likely to make use of gas. Such, however, is not the author's meaning. He strongly advocates coal-gas as an illuminating material, but urges that it is, generally speaking, consumed in an unscientific manner, so that the consumer gets the smallest quantity of light with the greatest expense and nuisance. Mr. Wilson first gives a popular description of the nature of coal-gas, of flame, combustion, air-supply, and smoke. He then passes to a consideration of the qualities of gas, its illuminating power, the standards legally fixed, and the comparative cost of gas in different towns when sale, price, and quality are both taken into consideration.

From the figures given, it appears that the highly illuminating gas of Glasgow, Manchester, and to a less degree of Liverpool, though charged a higher price per thousand cubic feet than the poorer gas of Birmingham, Sheffield, Leeds, or Bristol, is in effect the cheaper. But the difficulty is in getting the public to recognise such facts. The gas company in one of the latter towns had some few years ago an amateur manager, of whom it was facetiously said, that if unable to make good gas, he could do a far harder thing—induce his fellow-townsmen to burn bad gas contentedly, to pay for it cheerfully, and believe in its excellence. The author, however, maintains that with ordinary burners, instead of getting 15 candle light from common gas, five or six candles is the rule. In Glasgow, where the gas is exceptionally good, five or six candles is the rule, instead of the 27 candles at which the gas is supplied, and instead of the 20 candles that can be easily obtained. The higher the quality of gas the greater will be the care required to burn it, so as to get all the light out of it without producing smoke." By the way, it would be interesting to compare the quality of the gas supplied by companies with that furnished by municipal authorities. We strongly suspect that the illuminating power of the latter would be found to average higher.

In his third chapter Mr. Wilson sets forth the advantages of using gas, going in this direction further than we are disposed to follow. He fully recognises the existence of sulphur in coal-gas, and the consequent production of sulphurous acid and ultimately of sulphuric acid in the atmosphere of our rooms. But he contends that it is questionable if the small amount of acid thus generated is capable of doing injury to persons. This may possibly be the case. But if, as our author admits, such acid fumes are capable of damaging books, furniture, and articles of metal, we cannot deny that this is a most serious drawback. It may be true that "light for light" gas is less unhealthy than candles or oil, if we measure unhealthiness simply by the quantity of carbonic acid gas generated. But the author admits that gas is generally used extravagantly, that 50 per cent of its nominal power "should be deducted to allow for the loss by burners and globes, and the height from table," and that gas, as ordinarily burnt, is more injurious than any of the other systems of lighting. That an improved system of ventilating houses, joined to a careful selection of perfect gas-fittings, would very greatly diminish the evil effects of gas is perfectly true. But to nine-tenths of the British public this is but poor consolation. Few, indeed, live, or can live, in houses so arranged that the products of combustion can pass away at or near the ceiling. The author's plea that "instead of being an objection to its use, the smell should rather be considered as one of the greatest advantages in using gas" is highly *naïve*. It may, indeed, be an advantage in coal-gas as against a supposed inodorous gas which might escape unperceived. But how it can be an advantageous feature in gas, as compared with lamps or candles, we fail to perceive. To the student who wishes to economise his eyesight, the flickering of gas, which, in practice, never burns with the steadiness of a well-trimmed lamp, is no small annoyance. There is another evil resulting from gas-lighting, to which the author makes no reference: the pollution of the subsoil in our streets. London has scarcely been lighted with gas more than half a century, yet whenever a road is taken up, how frightful is the odour of the earth which has been in contact with the gas-pipes and has absorbed the leakage. And herewith is connected a further peril: a house where the gas-fittings are faultless, or even one not lighted with gas at all, may become the scene of an explosion, owing to the escape from an adjacent main. All these defects, and others which we have here not space to mention, make us hope that gas may soon "pale its ineffectual fires" before the light of the future,—the electric light. Giving off neither carbonic acid, sulphurous acid, nor watery vapour, incapable of exploding or of occasioning conflagration or nuisance, and possessing a purity and brilliance in comparison of which the best gas-flame appears of a dirty yellow, it cannot fail, before long, to be introduced at least in our squares, churches, railway stations, public halls, and other large spaces requiring illumination.

But though we cannot join the author in his recommendation of gas, we are bound to admit that to gas consumers a careful perusal of his work may save a very heavy amount of expense and annoyance. He points out the errors of the gas-fitters in a style that marks the man of extensive experience and close observation.

COMPOSITION AND QUALITY OF THE METROPOLITAN WATER.

April, 1878.

The following are the returns of the Society of Medical Officers of Health:—

	Appearance in 2 foot Tube.	Ammonia. Saline.	Ammonia. Organic.	Nitrogen as Nitrates, &c.	Oxygen used to Oxidise Organic Matter.	Total Solids.	Lime.	Magnesia	Chlorine.	Sulphuric Anhydride.	Hardness on Clark's Scale. Before Boiling.	Hardness on Clark's Scale. After Boiling.
		Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Thames Water Companies.												
Grand Junction	Clear	0·000	0·009	0·105	0·089	18·00	7·840	0·360	0·79	1·430	12·1	3·30
West Middlesex	Clear	0·000	0·009	0·129	0·053	17·10	7·840	0·396	0·87	1·430	12·6	2·80
Southwark and Vauxhall	Clear	0·000	0·008	0·105	0·046	18·10	7·890	0·432	0·87	1·480	12·6	2·80
Chelsea	Clear	0·000	0·008	0·150	0·046	18·20	7·750	0·396	0·87	1·330	12·6	2·80
Lambeth	Clear	0·000	0·008	0·164	0·042	19·40	8·170	0·432	0·94	1·500	13·2	3·30
Other Companies.												
Kent	Clear	0·000	0·003	0·435	0·014	28·70	11·480	0·540	1·44	3·560	19·4	6·00
New River	Clear	0·000	0·006	0·165	0·042	17·40	7·840	0·360	0·87	0 930	12·6	2·40
East London	Clear	0·000	0·008	0·165	0·042	18·70	7·630	0·430	1·08	1·600	12·6	3·30

The quantities of the several constituents are stated in grains per imperial gallon.

Note.—The amount of oxygen required to oxidise the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the Metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it

C. Meymott Tidy, M.B

CORRESPONDENCE.

DETECTION AND ESTIMATION OF FREE MINERAL ACID IN SULPHATE OF ALUMINA.

To the Editor of the Chemical News.

Sir,—As a brief extract of the paper read before the Chemical Society which appeared in the Chemical News, vol. xxxvi., p. 211, is not accurate in some of its details, may I beg to offer the following correction. In qualitatively testing for free acid I use a *very weak* solution of the peracetate, but for quantitative results a *strong* one. For the quantitative method, which your reporter alone gives, a much stronger solution than the one described will be found necessary.—I am, &c.,

A. Esilman.

Manchester, May 29, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 17, April 29, 1878.

Production of the Laminary Systems of Plateau.—A. Terquem.—The author, by substituting in the polyhedra of Plateau flexible wires for a certain number of rigid rods, produces very readily and with a minimum quantity of liquid laminary systems of very considerable dimensions.

Ultra-violet Absorption Spectra of the Earths in Gadolinite.—J. L. Soret.—The author has been repeating the observations of MM. Marignac and Delafontaine, which show the presence of yttria and erbia, and probably of terbia (erbia of Mosander). A fourth earth which the author merely designates as x seems likewise to be present. The author appends to his paper a diagram of the spectra of the four bodies.

Formation of Metallic Arsenides.—A. Descamps.—An account of the arsenides of lead, nickel, cadmium, zinc, iron, bismuth, tin, and antimony.

Electric Discharge in Tubes Containing Rarefied Gases.—MM. Warren de la Rue and Hugo W. Müller.—The discharge in a tube of rarefied gas does not differ from that which takes place in air or other gases at the atmospheric pressure. It is not a current in the ordinary sense of the term, but a disruptive discharge, the gaseous molecules effecting a transport of electrisation. The gases probably receive two impulsions in opposite directions, that from the negative electrode being the more continuous. There are sometimes formed metallic spots upon the tubes, which leave a permanent trace of the intervals comprised between the strata.

Magnetic Rotation of the Plane of Polarisation of Light under the Influence of the Earth.—H. Becquerel.—The author describes an experiment for demonstrating the above phenomena.

Suppression of the Return Wire in the Use of the Telephone.—M. Bourrouze.—The authors have found that the circuit may be closed by the earth without a return wire, the sounds being transmitted with great distinctness.

Transparence of Coloured Flames for their Own Radiations.—M. Gouy.—An account of the result of spectroscopic researches on narrow rays. The author adds in conclusion that in conjunction with M. Thollon he has studied the spectrum of barium, and has succeeded in resolving its bands into a great number of fine rays, perfectly well defined.

Vapour Density of Ammonium Sulphide.—G. Salet.—On mixing equal volumes of hydric sulphide and of ammonia at the temperature of 80° no contraction was observed.

Solution of Platinum in Sulphuric Acid.—M. Scheurer-Kestner.—In a former communication (*Comptes Rendus*, lxxxi., p. 892) the author has shown that during the industrial concentration of sulphuric acid in vessels of platinum, the quantity of this metal dissolved in acid free from nitrous compounds increases with the concentration of the acid. New experiments undertaken for the purpose of preparing fuming sulphuric acid have induced him to continue his observations. The action upon the metal, so much promoted by concentration beyond 95 per cent, is still further intensified with the concentration of the monohydrated acid. On decomposing sodium bisulphate by heat in earthen retorts lined with platinum, 1 grm. of metal was dissolved for each kilo. of fuming acid produced. The metal is found in a soluble state mixed with the sodium sulphate.

On Vitreous Melted Saccharose.—H. Morin.—If heated with water under certain conditions saccharose is transformed into a vitreous product, which preserves its transparency more or less according to the manner of cooling. If this has taken place gradually the product is translucid, but mixed with prismatic crystals. If the cooling is rapid this partial crystallisation is avoided. It contains on an average 3·28 per cent of water, and its sp. gr. at 14·5° is 1·966.

Certain Derivatives of Isobutylic Ether.—E. Demarçay.—In a former communication the author has shown that it is possible by means of ethylacetic ether to obtain a series of compounds corresponding to the formulæ:—$3C_nH_{2n-4}O_2+H_2O$ and $3C_nH_{2n-4}O_3+H_2O$ The process for obtaining these acids consists in decomposing with alcoholic potassa the bromised derivatives of the substituted acetylacetic ethers. The author has now examined this reaction upon isobutylacetic ether, and ascertained the circumstances and the secondary reactions which determine or accompany the formation of this body.

No. 18, May 6, 1878.

Extension of Fourier's Formulæ Relating to the Propagation of Electricity.—A. Cornu.—There is a complete similarity of movement between the transmission of electricity and that of elastic waves, and the expression "electric wave" is under certain conditions perfectly justifiable.

Telegraphic Use of the Telephone.—M. Gressier.—An inquiry into the nature of various sounds heard when the telephone is connected with or runs in the proximity of a telegraphic line. After the paper had been read M. du Moncel pointed out that the currents mentioned by M. Gressier had been long ago studied with simple galvanometers, and had been the subject of four memoirs presented by him to the Academy of Sciences in 1872 (*Comptes Rendus*, lxxv., p. 956, 1098, 1504, and 1622).

Crystallisation of Silica in the Dry Way.—P. Hautefeuille.—Acid phosphate of soda and tungstate of soda are both agents in the mineralisation of silica, but the latter exerts a more energetic action, even at a lower temperature, which permits its employment for the reproduction of the numerous silicates, more or less fusible, associated with silica in rocks.

Isobutylacetylacetic Ether.—Eug. Demarçay.—In a previous communication the author has described the different reactions which monobromated isobutylacetylacetic acid undergoes under the influence of alcoholic potassa. He now makes known the processes by means of which the different products are prepared and separated.

A New Method of Preparing Propyl-glycol.—M. Hanriot.—The author employs aceto-brom-hydrine, which is easily prepared by the action of acetyl bromide upon glycerin. The product of the reaction is distilled in a vacuum, and passes over almost entirely about 175° under a pressure of 10 centimetres of mercury. The hydrogenisation is conducted in a neutral liquid by means of Dr. Gladstone's coppered zinc, and is completed in about twenty-four hours. The product when hot is mixed with carbonate of potassa in excess and the paste is exhausted with alcohol. The acetate of propyl-glycol, saponified by an alcoholic solution of potassa, yields isopropyl-glycol.

An Isomer of the Monochlor-hydrin of Glycerin.—M. Hanriot.—Theory points to the existence of two isomers for the first hydrochloric ether of glycerin, one representing chlorated propyl-glycol and the other chlorated isopropyl-glycol. M. Berthelot has obtained the second of these ethers by the action of hydrochloric acid upon glycerin. The author finds that the same reaction yields also a small quantity of the former.

Decomposition of Ethylic Alcohol by Zinc Chloride at High Temperatures.—W. H. Greene.—The products of the reaction were in addition undecomposed alcohol, a small quantity of ether and oily products, which are probably polymers of ethylen, aldehyd, and water.

Novel Method of the Formation of Oxide of Ethyl.—W. H. Greene.—On heating sodic oxide to 180° with ethyl iodide the author observed the formation of a notable quantity of oxide of ethyl.

Berichte der Deutschen Chemischen Gesellschaft, No. 4, March 11, 1878.

Preliminary Communication Concerning a New Chloride of Camphor.—F. V. Spitzer.—When the action of pentachloride of phosphorus upon camphor is conducted so as to avoid every elevation of temperature there is formed an almost pure bichloride of camphor. It is distinguished from the compound described by Pfaundler by its melting-point, which is from 150° to 155°, whilst Pfaundler's bichloride melts at 70°.

Chlor-cymol Obtained from Thymol, and Closely Connected Compounds.—E. v. Gerichten.—Not adapted for useful abstraction.

Boiling-points of Sulphuric Acid at Various Degrees of Concentration.—G. Lunge.—From the table drawn up by the author it appears that sulphuric acid of sp. gr. 1·8400 (at 15°) boils at 297°, and that of sp. gr. 1·0580 at 101·5°.

Oxytoluylic and Oxyphthalic Acids.—O. Jacobsen.—The author has obtained four oxytoluylic and four oxyphthalic acids from the four xylenols which he has recently discovered.

Formation of Dichlor-propionic Acid from Pyruvic Acid.—H. Beckurts and R. Otto.—The formation of α-dichlor-propionic acid from pyruvic acid by the action of phosphorus pentachloride does not depend upon any process which goes off evenly, and it would therefore be hazardous to regard pyruvic acid as a keton acid of the formula $CH_3 \cdots CO \cdots COOH$.

Constituents of Corallin.—K. Zulkowsky.—These are a garnet-red body with a blue surface reflection, but without metallic lustre, forming large crystals, $C_{19}H_{14}O_3$. A derivative of this substance, $C_{19}H_{16}O_6$, which crystallises readily in small violet needles, and is easily decomposed by heat. A compound, $C_{20}H_{16}O_3$, crystallising in green needles, with a metallic lustre. The hydro-product of the above, $C_{20}H_{18}O_3$. An amorphous resinous substance, colourless when pure. An oxidation-product of the above; a deep red amorphous powder with a slight metallic lustre: in its properties it agrees with the compound which Baeyer obtained from phthalidein and phenol. The aurin of Dale and Schorlemmer was not to be found in the author's corallin.

An Isomeric Nitrophthalic Acid.—O. Miller.—The author announces a full description of this compound as to appear in the *Proceedings* of the Russian Chemical Society.

Zinc Ores from the Neue Helene Grube, at Scharley, near Beuthen, in Upper Silesia.—A. Lindner.—A geological and chemical account of the ores, and of the limestones in which they are contained.

On Azophenols.—P. Weselsky and R. Benedikt.—Ortho-azophenol, $C_{12}H_{10}N_2O_2$, forms splendid leaflets of a golden lustre, soluble in alcohol and ether, but perfectly insoluble in water. It dissolves in potash-lye with a fine reddish yellow colour, and is re-precipitated unchanged by acids. It melts at 171°, and sublimes undecomposed.

Action of Chloro-carbonic Oxide upon Xylol in Presence of Chloride of Aluminium.—E. Ador and A. Rillet.—The result of the reaction is a keton, which boils at 340° and does not congeal, even if kept for twenty-four hours at −60°.

Examination of the Action of a Copper-zinc Element upon Alkaline Oxy-salts.—J. H. Gladstone and A. Tribe.—Translated from an English source.

MISCELLANEOUS.

Soirée of the Chemical Society.—On Thursday, May 30th, Dr. Gladstone, F.R.S., P.C.S., gave a *soirée* to the Fellows of the Chemical Society, at Burlington House. Amongst the numerous objects of interest were the following:—A magnificent collection of immediate principles from the brain, exhibited by Dr. Thudichum, who also demonstrated the absorption-spectrum of a new colouring matter, ovocruentin, derived from egg-shells, the bands being identical with those of cruentin obtained from the blood. In the library were specimens of artificial corundum and emerald, made by Feil and Frémy; a large Cape diamond, exhibited by Prof. Tennant; a collection of precious stones from Hunt and Roskell, including a fine pink topaz, cat's-eyes, and a large crystal of garnet; some interesting apparatus of Faraday, amongst which was his rheostat; a collection of alkaloids from opium, aconite, and veratrum, by Dr. Wright; a splendid case, by W. H. Perkin, illustrating the colouring-matters from aniline, anthracen, &c.; a specimen of artificial alizarin, and preparations of natural and artificial salicylic acids, the latter of which the exhibitors, Messrs. Hopkin and Williams, have succeeded in obtaining in crystals exactly resembling those of the natural product; minerals containing liquid carbonic acid were shown by W. N. Hartley, who also demonstrated the effect of heat on the liquid enclosed in the cavities; crystals from Owen's College, including a large, almost perfect, octahedron of chrome alum; various interesting products, &c., were exhibited by Prof. Odling, Prof. Frankland, Dr. Russell, Dr. Armstrong, Dr. Witt, Dr. Schorlemmer, Dr. Hugo Müller, and M. M. P. Muir. In the room adjoining the lecture room were some candles which had been acted upon by sea water for 173 years, a large collection of meteoric stones, an interesting series of photographs of invisible fluorescent bodies, &c., exhibited by the President; a splendid photograph of the solar spectrum, shown by Prof. Rutherford; the spectrum of bismuth was shown by Messrs. Browning; dichroic crystals of nickel and cobalt salts, by J. M. Thomson; photographs illustrating recent researches in solar chemistry, by J. N. Lockyer; an enormous cut cairngorm, weighing 51 ozs., an opal cameo, and various minerals, by Bryce Wright, &c. In the lecture and preparation rooms were the microphone, exhibited by Prof. Hughes, which attracted considerable interest. Mr. W. De La Rue showed some phosphorescing tubes, which, after a momentary exposure to some burning magnesium, flashed back all the colours of the spectrum; Byrne's pneumatic battery and the copper-zinc couple were shown in action.

Messrs. Murray and Heath exhibited under the microscope some pretty crystals of gold, silver, &c. Sir Joseph Whitworth and Dr. Siemens showed specimens of steel; in the same room Dr. Guthrie exhibited the formation of cryohydrates. Many other objects of interest were exhibited, but it would be impossible to enumerate all. On the whole, the *soirée* was most successful, and although the attendance was numerous the arrangements were so good that at no time were the rooms inconveniently crowded.

MEETINGS FOR THE WEEK.

SATURDAY, 8th.—Physical, 3. "The Microphone," Prof. Hughes. "The Electrical Properties of Bees'-wax and Lead Chloride," Prof. Ayrton. "The Reflection of Polarised Light," Sir J. Conroy.
TUESDAY, 11th.—Royal Institution, 3. "Minute and Low Forms of Life," Rev. W. H. Dallinger.
—— Photographic, 8.
—— Anthropological Institute, 8.
THURSDAY, 13th.—Royal Institution, 3. "On Molecular Physics: Solids," Prof. Guthrie.
—— Mathematical, 8.
FRIDAY, 14th.—Royal Institution, 8, Weekly Meeting. "Liquefaction of Gases," Prof. Dewar, 9
—— Astronomical, 8.
—— Quekett Club, 8.
SATURDAY, 15th.—Royal Institution, 3. "On Joseph Addison," Prof. Henry Morley.

Just completed, a few copies of

FARADAY'S EXPERIMENTAL RESEARCHES IN ELECTRICITY (1839-55), 3 vols., 8vo., with 16 plates, cloth, £2 8s.

Each volume sold separately for 21s.

This book is still the great text-book of Electricians, and will always remain the Master Key of the science. New discoveries may and will be made, but to Faraday's Researches the scientific world will always have to refer as to their *Magnum Opus*.

Copies have lately sold for seven and eight guineas: the above should therefore be secured at once before the price rises again.

BERNARD QUARITCH, 15, Piccadilly, London.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V. GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

PROFESSOR HUGHES'S MICROPHONE.

Six Daniell Cells and Materials for Constructing Microphone for 21s.; carriage paid to any part of England. Telephones fixed or exhibited. Electric Bells, and all descriptions of Electrical Apparatus for Telegraph and for Experimental Purposes. —Edward Paterson, Electrical Engineer, 3, Bedford Court, Covent Garden, W.C.

A Firm of Manufacturing Chemists, having spare capital and portion of premises unemployed, are willing to enter into arrangements to add further manufactures to their business. There are several tanks available, and a plentiful supply of water and steam.—Address, in full confidence, to X. Y. Z., care of Mr. Jones, Operative Chemist, 386, Kingsland Road, London.

To be Sold, by Private Contract, an excellent and old-established Chemical Manufacturing and Drysalting Business, together with extensive works at Manchester, Glasgow, and Ayr. The business is a very lucrative one, and is in full working order. The sole reason for selling is the death of the last surviving partner. Only principals or their solicitors will be treated with.—Apply to Slater, Heelis, and Co., Solicitors, 75, Princes Street, Manchester.

MR. COX, VALUER OF CHEMICAL PLANT, offers his services on the usual terms. Twenty years' experience. Estimates for all description of plant, plans, &c.—Glenmohr House, New Charlton, London, S.

MANCHESTER CORPORATION GAS-WORKS.

AMMONIACAL LIQUOR.

The Gas Committee of the Corporation of Manchester are prepared to RECEIVE TENDERS for the PURCHASE of the AMMONIACAL LIQUOR to be produced at their Gaythorn and Rochdale Road Works during a period of one or more years, commencing from the 1st day of January, 1880. In addition to tenders for the purchase of the liquor in its crude state, the Committee will also be prepared to consider tenders for its disposal, either by manufacture into sulphate of ammonia at the above-mentioned works on their behalf, or in any other manner. The Committee reserve to themselves the option of accepting the offer the terms of which they deem most advantageous. They do not bind themselves to accept the highest or any tender. Sealed tenders, addressed to the Chairman of the Gas Committee, Town Hall, and endorsed "Tender for Ammoniacal Liquor," must be delivered at these offices on or before Thursday, the 1st day of August next.—Forms of tender and further particulars can be obtained on application to Mr. George B. Jackson, at the Gas Offices.—By order of the Gas Committee,

JOSEPH HERON, Town Clerk.

Town Hall, Manchester, 31st May, 1878.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove and the cleanliness of application makes this one of the marvels o household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing rare Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for tudents, Schools, Colleges, &c.

NEW PATTERNS OF GEOLOGICAL HAMMERS.
NEW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
88, CHARLOTTE STREET, FITZROY SQUARE

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester

SPECIALITIES.

MANGANESE Lump, Crystallised, Ground, and Prepared Large stock of every description. *** *Suitable for all Trades.*
ARSENIC Refined powdered, Lump, Grey, and Ruby.
FLUOR-SPAR Finest produced. Medium and Common for all purposes.
BARYTES Carbonate and Sulphate. All qualities of Lump and Ground.
BAUXITE Of high percentage of Alumina and low in Iron;

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,
MINERAL AND CHEMICAL BROKER,
5, CHAPEL STREET, LIVERPOOL

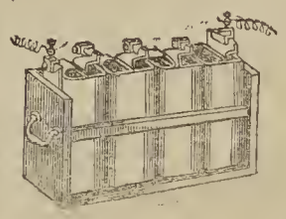
NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

ROYAL POLYTECHNIC.—THE SIEGE OF TROY has been reproduced, with new Scenery and Effects; rendered by Mr. Lin Rayne, supported by an efficient Staff.—THE CHEMISTRY OF THE SUN, by Prof. Pepper.—CLAY AND THE POTTER, by Prof. Gardner.—MODERN GUNS AND PROJECTILES, by Mr. J. L. King.—CLEOPATRA'S NEEDLE by Mr. W. R. May.—BULGARIA, by Mr. E. Wilkie.—Dr. SAMUEL JOHNSON AND HIS FRIENDS, by Dr. Aveling.—THE TELEPHONE, THE OXY-HYDROGEN MICROSCOPE, and TORPEDOES, by Mr. King.—HAYLING ISLAND, WHERE IT IS AND ALL ABOUT IT, by Mr. J. L. King.—Admission to the whole, 1s.; Schools and Children under Ten, 6d. Reserved Stalls including Admission), 2s. 6d. Open at 12 and 7; Carriages at 5 and 01.

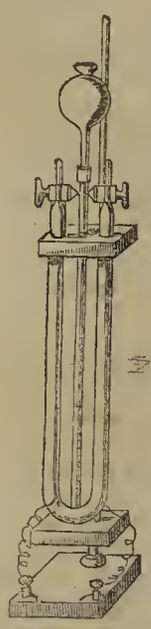
CHEMICAL & SCIENTIFIC APPARATUS,

WHOLESALE AND RETAIL.

EVERY DESCRIPTION OF APPARATUS FOR STUDY, LECTURES, OR RESEARCH.



Country Orders, accompanied by a remittance, executed same day as received; and carriage paid in England and Wales if over £2 in value.



PRICE LISTS POST FREE ON APPLICATION.

M. JACKSON AND CO.,
65, BARBICAN, LONDON.

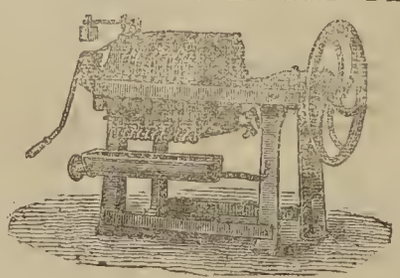
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

The speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

THE CHEMICAL NEWS.

Vol. XXXVII. No. 968.

ON AREOMETERS.*—Part I.

By P. CASAMAJOR.

The last paper which I had the honour of reading before this Society related to the corrections of the errors due to changes of temperature in volumetric analysis; and although the results which I gave found their application in an important branch of chemical science, I am not sure that my paper had otherwise a very close connection with chemistry. The favourable reception of this paper by many members, who have expressed to me a great interest in its subject, induces me to offer you, this evening, a paper of a similar character on areometers. Such is the constant use made by chemists of these useful and convenient instruments that I feel I owe no apology for presenting the subject. In the first place, I propose to examine the nature of the scales of the areometers most generally used, and, in the second place, to apply the data obtained by this examination, and those given in the last paper which I read before this Society, to the correction of the errors resulting from variations of temperature.

Part First.—Scales of Areometers.

A great portion of what I have to say on the scales of areometers I have published already on several occasions;† and although it is with regret that I have to present you with matter that I have published elsewhere, I have found no way of avoiding it, as otherwise the new matter I have to present would be incomprehensible.

Areometers are formed of two portions—the stem, which bears the graduation, and the bulb, whose diameter is considerably larger, and whose object is to avoid excessive length of the instrument. I must, however, for the purpose of studying the graduation of areometers, discard the bulb, and suppose that we have a geometrical cylinder of indefinite length.

If this areometer (A B) is to be used for liquids heavier than water, we will suppose that its weight is such that, when immersed in pure distilled water, at the normal temperature, it will sink to a point, *c*, near the top of the cylinder. This is an important reference point in all areometers, as it corresponds to the unity of specific gravities of liquids.

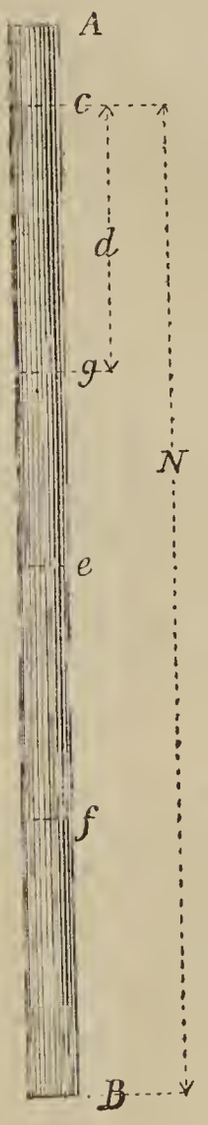
As a floating body is in the state of equilibrium in a liquid when the weight of the liquid displaced is equal to the weight of the floating body, if we place our cylindrical areometer, which sinks to *c* in pure water, in a liquid whose specific gravity is double that of water, it will sink to a point *e*, placed in such a manner that—

$$Be = \frac{Bc}{2}.$$

This happens because, in a geometrical cylinder, the distances B*c*, B*e* are proportional to the volumes between these points, and because the new liquid, being twice as heavy as water, takes half the volume to float the areometer. In the same manner, if it was possible to obtain a liquid four times heavier than water, the areometer would sink to a point *f*, so placed that—

$$Bf = \frac{Bc}{4}.$$

If now we call the specific gravity of water 100, and if we place numbers opposite to *c*, *e*, *f*, which express the corresponding specific gravities, we shall have 100 opposite to *c*, 200 opposite to *e*, and 400 opposite to *f*. If we make intermediate divisions, each expressing an increase of specific gravity equal to 1-100th part of the specific gravity of water, there will be 100 such divisions between *c* and *e*, and 200 between *e* and *f*. The space *ef* is, however, one-half of *ce*, so that rhe mean length of a division between *c* and *e* must be four times greater than that of a division between *e* and *f*. By making the same calculation for any portion of the stem, we may see that the decrease of the length of the divisions is gradual from *c* to *f*. A scale of this kind is called *uneven*.



We may, on the other hand, starting from the point *c*, divide the space *c*B into a certain number of equal parts. A scale of this kind is called *even*, and I may remind you that the greatest portion of the areometers used in the arts have even scales.

We are naturally led to inquire whether any relation exists between even scales and scales expressing specific gravities. I have seen it clearly stated in books that no such relation exists, and that the correspondences of these divisions are found by means of tables, which, it must be inferred, were obtained experimentally, or by means of empirical formulas.

I believe that Francœur was the first mathematician who studied the relations between these two classes of scales, and he has left us two formulas; one for Beaumé's areometer for liquids heavier than water—

$$P = \frac{152}{152 - d},$$

* Read before the American Chemical Society, April 5, 1877.

† "Testing Sugar Solutions" (*American Chemist*, Oct. and Nov., 1873). "On the Formula of Francœur, &c." (*Ibid.*, Feb., 1874). "Expansion of Sugar Solutions by Heat" (*Ibid.*, June, 1874). "Nouveau Procédé pour la Détermination du coëfficient de pureté des dissolutions sucrées" (*Moniteur Scientifique*, March, 1877).

and the other for Beaumé's instrument for liquids lighter than water—

$$P=\frac{146}{136+d}.$$

In these formulas P represents the specific gravity, while d is the corresponding degree of an even scale.

We shall have occasion to return to these formulas, after we have studied the general relation which exists between the divisions of even scales and their corresponding specific gravities.

To discover this relation, let us suppose that we have placed our cylindrical areometer in a liquid of specific gravity, P, and that it has sunk to a point, g, of the stem. As the weight of liquid which buoys up an areometer must be equal to the weight of the areometer itself, the volumes of liquid displaced are inversely as their specific gravities. Now if we divide the space cB into a certain number, N, of equal parts, and if we find a number (d) of these divisions between c and g, the distance cB, which is the portion submerged in pure water, will be expressed by N divisions or degrees, while the space gB, the portion submerged in a liquid of specific gravity P, will be $N-d$, and we shall have the equation—

$$\frac{P}{1}=\frac{N}{N-d},$$

from which, knowing d, we may calculate the value—

$$N=\frac{Pd}{P-1} \quad . \quad . \quad (1)$$

From this equation we may find the whole number of degrees of even scale from c downwards. This number N is obtained by multiplying the specific gravity by the corresponding number of degrees, and dividing this product by the difference between the same specific gravity and unity.

If we know the value of N for any scale, we may, inversely, calculate the value of d when P is known, or the value of P when d is known, by these formulas :—

$$P=\frac{N}{N-d} \quad . \quad . \quad (2)$$

$$d=N-\frac{N}{P} \quad . \quad . \quad (3)$$

In Beaumé's original areometer for liquids heavier than water, 15° corresponded to sp. gr. 1·109. Formula (1) will give us, in this case,—

$$N=\frac{1\cdot109\times15}{0\cdot109}=\frac{16635}{109}=152\cdot6.$$

If we neglect 0·6, formula (2) will give us—

$$P=\frac{152}{152-d},$$

as given by Francœur.

Although this formula was correct for the original *pese sel* of Beaumé, it does not answer for the instrument now sold as Beaumé's areometer, in which 66° correspond to the point to which the instrument sinks in sulphuric acid, H_2SO_4. Taking 1·845 for the specific gravity of H_2SO_4, we have by formula (1)—

$$N=\frac{1\cdot845\times66}{0\cdot845}=\frac{121770}{845}=144\cdot02, \text{ or } 144.$$

As Beaumé's areometer is extensively used in the arts, many chemical, technological, and pharmaceutical books give tables for the conversion of its indications into corresponding specific gravities. In these tables N is sometimes 152, sometimes 144, and at other times 145, 145·4, &c. It is a matter of some importance to determine the value of N in any table. Fortunately this may be done at a glance by observing the degree Beaumé which is equal to the fractional part of the number expressing the corresponding specific gravity. The quantity N is that specific gravity multiplied by 100. If we find in a table that 52° B = 1·52 sp. gr., then N = 152; for if in the equation—

$$P=\frac{152}{152-d}$$

we make d equal to 52, P will be 1·52, and if in the equation—

$$P=\frac{144}{144-d}$$

we make $d=44$, P will be 1·44.

It is very easy to do for other areometers what we have done for Beaumé's *pese sel*. Let us take, in the next place, Beaumé's areometer for liquids lighter than water, which is extensively used in this country for petroleum products of all kinds. Beaumé obtained the scale of this instrument by calling 0 the point of the stem to which the areometer sinks in a solution of 10 parts of salt in 90 parts of water, and 10° the point to which it sinks in water. The instrument is graduated from 10° upward.

To find the value of N, let us temporarily call 0 the point to which it sinks in pure water, and 10° the point to which it sinks in a solution containing 10 per cent of salt, whose specific gravity is 1·07353. By formula (1) we have—

$$N=\frac{1\cdot07353\times10}{0\cdot07353}=\frac{1073530}{7353}=145\cdot99, \text{ or } 146.$$

As in this instrument the total number of degrees below 0 is 136, when the degree indicated is d the volume that sinks in the liquid is $136+d$, and we have—

$$\frac{146}{136+d}=\frac{P}{1},$$

whence—

$$P=\frac{146}{136+d},$$

and—

$$d=\frac{146}{P}-136.$$

This formula was also given by Francœur.

Next to Beaumé's *pese esprit*, we are naturally led to speak of Cartier's areometer, much used in the South of France for brandies. In this instrument 10° correspond to sp. gr. 1, as in Beaumé's, but 40° correspond to 44° B.; therefore the space occupied by 11° B. corresponds to 10° Cartier, and the value of N is—

$$\frac{146\times10}{11}=132\cdot72,$$

nearly 133, and the formula giving the relations of the specific gravities to degrees Cartier become—

$$P=\frac{133}{123+d},$$

$$d=\frac{133}{P}-123.$$

In the next place I propose to apply our formulas to an areometer of even scale, of which we heard a great deal at our last meeting. I mean the lactometer of the New York Board of Health. In this instrument 0 represents the point of the stem to which it sinks in pure water, and 100° represents the point to which it sinks in a liquid having the specific gravity 1·029.

Formula (1) becomes in this case—

$$N=\frac{1\cdot029\times100}{0\cdot029}=\frac{102900}{29}=3548\cdot2,$$

in which we may neglect 0·2.

Formulas (2) and (3) become—

$$P=\frac{3548}{3548-d},$$

$$d=3548-\frac{3548}{P}.$$

In the next place I propose to apply these formulas to the areometer of Balling, which shows the quantity of sugar, by weight, in 100 parts of a solution. Although this areometer, as found at the dealers, has always an even scale, the percentages of sugar cannot be expressed by such a scale. We may, however, if we only take a limited portion of a scale, in which every degree represents an additional 1 per cent of sugar, have an even scale in which the errors are not appreciable, by taking for the average length of every degree the length of the degree equally distant from the extremes. The Balling areometer, which I use in my process for testing sugar solutions, ranges from 5° to 15°, and I have adopted an even scale of which 1·805° is equal to 1° Beaumé, this being the relation at 10° Balling. For this instrument, to which we shall have occasion to refer in the second part of this paper, the value of N is $144 \times 1{\cdot}805 = 259{\cdot}92$, or 260. For the whole Balling scale I have found that the formula $D = 1{\cdot}8\,d + 0{\cdot}002\,d^2$, in which D is the degree Balling, and d the degree Beaumé, gives values of D which are correct within less than ½° Balling up to 75° Balling, thus :—

10° Beaumé	give	18·2	instead of	18·05
20	,,	36·8	,,	36·44
30	,,	55·9	,,	55·47
40	,,	75·2	,,	75·27

Having now examined, to specific gravity scale, Beaumé's two areometers, the *pese esprit* of Cartier, the lactometer of the Board of Health, and the areometer which indicates the percentage of sugar in a solution, I believe I have reviewed all the instruments of this kind that are used to any extent, except alcoholometers and Twaddle's hydrometer. Alcoholometry is too extensive a theme to be brought incidentally into our subject. Besides, little or nothing remains to be said about it after the labours of Tralles and Gay-Lussac. As to Twaddle's scale, it is a disguised specific gravity scale, in which the specific gravity of water, instead of being 1, is 200. This number, however, is subtracted from the indication. Thus, specific gravity 1·12 is 240, but is written 40 ; specific gravity 1·8 is 360, but is written 160; so that to find the specific gravity corresponding to the indication of Twaddle's scale we must add 200, and divide the sum by 200.

There is a quality in areometers called *sensitiveness*, by virtue of which a small difference of density in liquids corresponds to a decided difference in the scale of the instrument. If we suppose that our areometer is a geometrical cylinder, the distance between two indications of the scale corresponding to two specific gravities is proportional to the whole length of the instrument, from the point corresponding to pure water to its lower extremity. From this we may deduct a convenient method of expressing numerically the sensitiveness of an areometer by supposing it to be a geometrical cylinder, and stating its length in inches. This quantity is easily calculated, in the case of an even scale, by finding a certain number of inches corresponding to a certain number of degrees. If we take the coarse Beaumé areometer, having a thick stem, which is commonly used in the arts, in which 12½° are comprised in the length of an inch, we shall find the whole length to be—

$$\frac{144}{12\frac{1}{2}} = 11\frac{1}{2} \text{ inches.}$$

In the lactometer of the Board of Health 100° occupy 3⅝, or 3·625 inches ; then the whole number of degrees, 3548, would occupy—

$$\frac{3{\cdot}625 \times 3548}{100} = 128{\cdot}61 \text{ inches} = 10 \text{ feet } 8{\cdot}61 \text{ inches.}$$

In the areometer which I use for testing sugar solutions, 6° Balling, divided into tenths, occupy 2½ inches, so the whole number of degrees = 260 must occupy—

$$2{\cdot}5 \times \frac{260}{6} = 111\frac{2}{3} \text{ inches} = 9 \text{ feet } 3{\cdot}6 \text{ inches.}$$

To find the total length of a specific gravity areometer we may calculate the number of degrees of an even scale which correspond to two points placed a known distance apart, and thence find the length corresponding to the whole number of degrees. Geisler's areometer for Ventzke's sugar test, studied in this way, gives a whole length of 200 inches, or 16⅔ feet.

We have seen that if we know the specific gravity of a liquid we may deduct the corresponding degree of any even scale, and *vice versa*. These relations afford us a sure method of verifying the correctness of the graduation of any areometer of even scale, by determining with the balance the specific gravity of a liquid, and comparing the corresponding division of even scale with the indication of the areometer under observation.

We may also convert the indications of any areometer of even scale into corresponding degrees of any other even scale. This is done by dividing the number of degrees to be converted by the total number of divisions of its kind, and multiplying this quotient by the total number of divisions of the kind we require. If we wish to know, for instance, what degree Beaumé is equivalent to 100° of the lactometer of the Board of Health, we shall find that—

$$\frac{100 \times 144}{3548} = 4{\cdot}058° \text{ Beaumé.}$$

Areometers of even scale have this precious property, that, provided the divisions are equal to one another, and the calibre of the stem is even, we may obtain accurate results by their use, even if the divisions have not the proper length, and if the point corresponding to pure water has been misplaced. By determining the specific gravity corresponding to two points of an even scale under observation, we may correct any indication of such a scale. In the *American Chemist* for October, 1873 (vol. iv., p. 130), and in *Sugar Cane* for January, 1874 (vol. vi., p. 28), these calculations may be found at full length.*

---

* On reading over the corrections for areometers of even scale, in the *American Chemist* for November, 1873, I find that the subject may be presented in a more satisfactory manner, and more in harmony with the results of this paper, as follows :—

To ascertain the correctness of an areometer of even scale, we find by compasses and callipers that the divisions are equal to each other, and that the calibre is even—otherwise the instrument is not fit for accurate work. If these two points are satisfactory, we make two solutions, A and B, of different densities, B being the more dense. A must correspond to one end of the scale, and B to the other, but both must be within the scale. The temperature of the solutions should not be very different from that of the room, so as to remain constant for some time. The areometer to be examined should be placed successively in each solution : let us call the two indications a and b. In the next place, the specific gravity should be taken by the balance, which we will call P for A, and P′ for B. The degrees corresponding to P and P′ are calculated in the case of the total number of degrees N, and we obtain—

$$c = N - \frac{N}{P},$$

$$e = N - \frac{N}{P'}.$$

If $a = c$ and $b = e$, the areometer is properly graduated.

If a is not equal to c, and b is not equal to e, but still $b - a = e - c$, the divisions of the scale are correct, but have been misplaced, the misplacement $m = c - a = e - b$, m being positive or negative, and it has to be either added to or subtracted from the degree of the areometer to effect the correction.

Again, a may be greater or smaller than c, and b greater or smaller than e, and at the same time $b - a$ is not equal to $e - c$. In this case the degrees themselves have not the proper length, and we are led to ask what is N′, the total number of degrees of the areometer under examination ? If we call n' the number of degrees between c and e, and n the number between a and b, we have the relation—

$$\frac{N'}{N} = \frac{n'}{n},$$

whence—

$$N' = \frac{n' N}{n}.$$

When the degrees of the scale have not the proper length, two

In conclusion of this first part I will examine a point which was introduced at our last meeting. We were told that if we refer the divisions of an areometer of even scale, and the corresponding specific gravities −1 to rectangular co-ordinates, the law of their relations is expressed by a right line. To those who remember their analytical geometry it is easy to show that this is not the case, for if we take the equation—

$$\frac{Pd}{P-1}=N,$$

which we have had to use repeatedly, and in which are comprised the quantities d and $P-1$, and if we multiply both terms by $P-1$ and divide them by P, we shall have—

$$d=(P-1)\frac{N}{P}.$$

Now the equation of the right line is of the form $d=m(P-1)$, in which m is a constant, while—

$$\frac{N}{P}$$

cannot be a constant as P is variable; therefore—

$$d=(P-1)\frac{N}{P}$$

cannot give a right line.

By actually referring d and $P-1$ to perpendicular co-ordinates, we find that the law is expressed by a curve which does not differ materially from an arc of a circle, which curve turns its concavity towards the abscisses. The greatest deviation from a right line takes place about midway between the two extremes. This may be illustrated by taking Beaumé's areometer from 0° to 50°, in which 0° corresponds to $P-1=0$, and 50° to $P-1=0{\cdot}532$. If the law was a right line we should have the numbers of the second column, while the actual numbers are those in the third column.

Degrees Beaumé.	$m=\frac{P-1}{a}=\frac{0{\cdot}532}{50}$ $m=0{\cdot}01064$	$P-1=d\frac{N}{P}$.	Difference.
10°	0·1064 (14°)	0·0746	0·0318
20°	0·2128 (25°)	0·1613	0·0515
25°	0·2666 (30°)	0·2101	0·0565
30°	0·3192 (35°)	0·2632	0·0560
40°	0·4256 (43°)	0·3846	0·0410

After the values of $P-1$, in the second column, I have placed between parentheses the nearest whole number of degrees to which they correspond.

(To be continued).

---

cases may occur:—(1.) The 0° (pure water, normal temperature) is in the right place. (2.) The 0° has been misplaced. If—

$$\frac{a}{c}=\frac{b}{e}=\frac{N'}{N},$$

the zero is in its place; and if we call d' any degree of the areometer under examination, the correct degree,—

$$d=\frac{d'\times N}{N'}.$$

If the 0 of the scale has been misplaced, the relation—

$$\frac{a}{c}=\frac{b}{e}=\frac{N'}{N}$$

does not exist. To discover the amount of displacement we must take either of the specific gravities, P or P', and determine the true degree corresponding to either a or b, on the base of N' being the total number of degrees. If we take a and sp. gr. P, the true degree,—

$$x=N'-\frac{N'}{P}.$$

The quantity $x-a$ shows the displacement m, which is positive if $x>a$, or negative if $a>x$, and the true degree—

$$d=\frac{N}{N'}(d'\pm m).$$

SOME REACTIONS WITH LINDO'S TEST FOR SOME OF THE BASES IN OPIUM.

By Prof. HOW.

The following reactions, got precisely in the way detailed by Mr. Lindo (Chem. News, vol. xxxvii,, p. 158), may be of sufficient interest to place upon record.

Papaverin dissolves in H_2SO_4 to a pale purple fluid, which becomes very pale and then brownish on standing about an hour. The addition of Fe_2Cl_6 and warming cause the purple colour to change quickly to yellow, while the liquid becomes turbid; the addition of water gives a colourless liquid, becoming pale yellow next day.

Narcotine dissolves to a bright yellow liquid, becoming orange on standing about an hour; then, treated as above, a blood red is produced, soon assuming a purplish tinge, then a bright red, resembling the ferric sulphocyanide, and remaining permanent at least for a fortnight.

Cotarnine gives first a clear, dark brownish yellow solution; then, with Fe_2Cl_6, a whitish precipitate, dissolving to a dark red fluid, which, with water, assumes much of the colour obtained with narcotine, but perhaps paler: it is equally permanent.

Narceine dissolves to an orange liquid, which becomes turbid and purplish, and finally of a pale red colour.

Strychnine dissolves to a colourless fluid, and affords successively a clear yellow and a colourless liquid.

Brucine gives first a pale amethystine solution, then orange-yellow, or red-yellow looking across the tube and red on looking down it; on further solution an amethyatine red, becoming pale, but still distinct, at the end of a fortnight.

Caffein gives successively a colourless, a bright yellow, and a colourless fluid.

Piperin dissolves to a deep red, nearly black, fluid, with a flocky deposit on heating with Fe_2Cl_6; the addition of water gives a yellow fluid, the deposit appearing dark brown; the fluid was nearly colourless the next morning.

Betulin gives a dirty green-brown fluid, becoming clear and colourless with water.

Coumarin gives an orange-yellow clear fluid, which water renders very pale yellow.

Phloridzin (from bark of stem and roots of the apple-tree) dissolves to a blood-red liquid, which is orange-coloured at first, if very little of the substance is used: water gives a small flocky precipitate, and leaves the solution of an orange colour.

Quinine sulphate, of commerce, dissolves to a pale yellow fluid, which turns deeper yellow when warmed with Fe_2Cl_6, and colourless with water.

Cinchonin, impure, gives clear yellow, turbid yellow, and yellowish liquids.

Beburin sulphate, in brown scales, dissolves to a very dark liquid, becoming red with more H_2SO_4; with Fe_2Cl_6 and warming, a dark green fluid—as seen over white paper—is produced, which gives with water a dirty yellow liquid.

King's College, Windsor, N.S.,
May 25, 1878,

Analysis of Tin Crystals.—MM. Goppelsrœder and Trechsel add to the salt of tin, in a hot solution, a known quantity of chromate of potassa, which converts it into stannic chloride. They decompose the excess of chromate with hydrochloric acid, pass the chlorine evolved into a solution of potassic iodide, and titrate the iodine set at liberty with sodic hyposulphite. Otherwise they dissolve the salt of tin after the addition of a known quantity of chromate and hydrochloric acid. When the reaction is concluded they add potassic iodide in excess, and after five minutes they titrate with hyposulphite.—*Zeitschrift für Analytische Chemie.*

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, June 6, 1878.

Dr. J. H. GLADSTONE, F.R.S., President, in the Chair.

AFTER the confirmation of the minutes of the preceding meeting the following certificates were read for the first time :—J. J. Watts, J. Treharne, E. W. Napper, and P. H. Walsh.

The first paper was read by Dr. GLADSTONE ; it was entitled "*Analogies between the Action of the Copper-Zinc Couple and Occluded and Nascent Hydrogen*," by J. H. GLADSTONE, F.R.S., and ALFRED TRIBE. The authors have recently shown that finely divided copper charged with hydrogen converts nitre into potassium nitrite and ammonia ; they have since found that hydrogen, in association with the same metal, reduces potassium chlorate to the chloride. They have observed that the copper-zinc couple in the presence of water converts nitrobenzol into aniline, a reaction which the authors have utilised for the detection of small quantities of nitrobenzol as follows :—"Add some 12 drops of strong copper sulphate solution to 3 or 4 pieces of zinc-foil (1" × ½) in about 5 c.c. of water ; wait till the liquid is completely decolourised, pour off the zinc sulphate solution, and wash the conjoined metals three or four times with water. Now add to this couple the nitrobenzol in solution or in suspension in water, heat nearly to boiling for about two minutes, filter, cool, and add drop by drop a solution of bleaching-powder. The nitrobenzol in 5 c.c. of a 0·05 per cent solution in water can thus be detected." The present paper contains chiefly the results of the authors as to the actions of palladium-hydrogen, platinum-hydrogen, and carbon- (cocoa-nut charcoal) hydrogen, on the substances enumerated in the table appended, which gives the principal reactions observed.

Substances Employed in Aqueous Solutions.	Substances Produced by—				
	Copper Zinc Couple.	Palladium-Hydrogen.	Platinum-Hydrogen.	Copper-Hydrogen.	Carbon-Hydrogen.
Potassium chlorate	Chloride	Chloride	Chloride	Chloride	Chloride
,, nitrate	Nitrite and ammonia*	Nitrite and ammonia*	Nitrite and ammonia ?	Nitrite and ammonia	No action
,, Ferricyanide	Ferrocyanide	Ferrocyanide*	Ferrocyanide		Ferrocyanide
Nitrobenzol	Aniline	Aniline	Azobenzene		
Indigo, in presence of weak potash..	White indigo	White indigo			
Sulphurous acid	Sulphur	Sulphuretted hydrogen	Sulphur ?		
Arsenious acid	Arseniuretted hydrogen	Arsenic	Arsenic		

The results marked * have been obtained by previous observers.

In conclusion the authors draw attention to the close analogy between the action of the copper-zinc couple, of occluded and of nascent hydrogen in some cases, and point out that the results corroborate their previous view that the power of the copper-zinc couple depends to a great extent on the hydrogen absorbed by the finely divided metal. They also discuss the various explanations of the above reactions. The paper was illustrated by some experiments, which were performed by Mr. Tribe.

Dr. RUSSELL took the chair during the reading of the above paper.

The next paper was read by Dr. WRIGHT, "*On the Alkaloids of the Aconites*," Part III., by C. R. A. WRIGHT and A. P. LUFF. The authors find that aconitin is readily dehydrated by heating in contact with acids (preferably tartaric), forming apo-aconitin,—

$$C_{33}H_{43}NO_{12} = H_2O + C_{33}H_{41}NO_{11}.$$

The new base closely resembles the parent alkaloid, and is formed from it during extraction to some extent. Its hydrobromide appears to be more soluble than aconitin hydrobromide, as the mixture of bases yields pure aconitin on conversion into hydrobromide, re-crystallisation, and regeneration of the alkaloid. By saponification aconitin splits up—

$$C_{33}H_{43}NO_{12} + H_2O = C_7H_6O_2 + C_{26}H_{39}NO_{11},$$

forming benzoic acid and a new alkaloid, aconin, readily soluble in water and chloroform, insoluble in ether. Probably the substances described as napelline and acolyctine by Hübschmann are aconin more or less pure. On treating aconitin with acetic or benzoic anhydrides it loses water, and forms a derivative in which H is replaced by an acid radical ; thus, acetyl-apo-aconitin,—

$$C_{33}H_{40}(C_2H_3O)NO_{11},$$

and benzoyl-apo-aconitin, $C_{33}H_{40}(C_7H_5O)NO_{11}$, are obtained. On treating aconin with benzoic anhydride it gives the same product as that formed by aconitin, so the formula of aconitin is indicated as—

$$(C_{26}H_{35}NO_7)\begin{matrix}OH\\OH\\OH\\OCOC_6H_5\end{matrix}$$

apo-aconitin being—

$$(C_{26}H_{35}NO_7)\begin{matrix}=OH\\-OH\\-OCO,C_6H_5\end{matrix}$$

and aconin being—

$$C_{26}H_{35}NO_7\begin{cases}OH\\OH\\OH\\OH\end{cases}$$

Dibenzoyl-apo-aconin or benzoyl-apo-aconitin has the formula—

$$C_{26}H_{55}NO_7\begin{matrix}=O\\-OCOC_6H_5\\-OCOC_6H_5\end{matrix}$$

Similarly pseudaconin gives rise to analogous derivatives, the dibenzoyl and diacetyl bodies having been prepared. Picraconitin splits up on saponification into benzoic acid and a new base picraconin (much resembling aconin), $C_{31}H_{45}NO_{10} + H_2O = C_7H_6O_2 + C_{24}H_{41}NO_9$. Besides crystallisable aconitin *A. napellus* yields a considerable quantity of non-crystalline alkaloids, which contain more carbon and are of lower molecular weight than aconitin. These are probably formed from aconitin by alteration during extraction. One conclusion to which the authors call special attention, drawn from the above research, is that no practical difficulty exists in preparing from *A. ferox* and *A. napellus* well crystallised salts or alkaloids of constant composition and high physiological activity, whence it is evident that the amorphous preparations, now sold as aconitin, which vary immensely, should be replaced by pure crystallised alkaloids. The commercial product often contains 40 and even 80 to 90 per cent of uncrystallisable bases more or less inert.

The next paper was "*On the Alkaloids of the Veratrums: Part I., Alkaloids of Veratrum Sabadilla* (Assagræa officinalis), by C. R. A. Wright and A. P. Luff. The authors discuss the results obtained by previous observers —Couerbe, Merck, Weigelin, Schmidt, and Köppen. The discrepancies observed between the results of these chemists are due to the alteration and decomposition of the original bases during the processes of extraction and purification. The authors have examined the alkaloids obtained from *V. Sabadilla* seeds by percolating the crushed seeds with alcoholic tartaric acid, evaporation, separation from resin, and extraction by numerous and prolonged shakings with ether. The alkaloids obtained were three—(1) Veratrine (Couerbe), $C_{37}H_{53}NO_{11}$. On saponification it splits up $C_{37}H_{53}NO_{11}+H_2O=C_9H_{10}O_4+C_{28}H_{45}NO_8$ (dimethyl-protocatechuic acid being formed: this acid is identical with Merck's veratric acid and the acid obtained by similar treatment from pseudaconitin), and a new base, Verin. The authors propose to restrict the name "Veratrin" to the above alkaloid. It does not crystallise, but its sulphate and hydrochloride can be obtained in the crystalline state. (2) Cevadin (veratrin of Merck), $C_{32}H_{49}NO_9$. This alkaloid was obtained by Merck and Schmidt and Köppen, who assigned to it slightly different formulæ. Weigelin also obtained this substance in a very impure condition. On saponification it splits up—

$$C_{32}H_{49}NO_9+H_2O=C_5H_8O_2+C_{27}H_{43}NO_8,$$

forming a new base, Cevine, and an acid identified as methyl-crotonic acid, and with the cevadic acid of Pelletier and Caventon. The benzoyl compound is beautifully crystalline. The formula of cevadin is probably—

$$(C_{27}H_{41}NO_6)\begin{matrix}-OH\\-O.COC(CH_3)=C_2H_2,\end{matrix}$$

and is probably closely connected with the aconite alkaloids. (3) A new base; amorphous, yielding no crystallisable salts, and forming cevadic acid on saponification, having a a formula $C_{34}H_{53}NO_8$. This body resembles to a certain extent Weigelin's sabadilline, but in other respects is quite dissimilar. The authors propose to call it *Cevadilline*. No trace of anything like Weigelin's sabadillin could be detected. A commercial product sold as "sabadillin" consisted chiefly of cevadillin. The above papers contain the details of forty to fifty analyses and quantitative determinations.

Dr. Gladstone said the Society had to thank the authors for the large amount of labour which they had bestowed on a subject of much difficulty, and for the positive knowledge which was now gained of substances, most undesirable to work with, in place of the varying statements hitherto published.

In answer to Mr. Maxwell Lyte, Dr. Wright said that the above alkaloids gave for the most part colour-reactions with sulphuric acid, but it was difficult to distinguish the colours when a small quantity of the alkaloid was present with much organic matter.

The next paper was by Mr. J. W. Thomas, "*On the Action of Hydrochloric Acid upon Chemical Compounds.*' It was read by the Secretary. The author has studied the action of hydrochloric acid on various substances in three ways:—(1) Chemical compounds were introduced into tubes containing hydrochloric acid gas standing over mercury. (2) A current of dry hydrochloric acid was passed over chemical compounds placed in a glass tube. (3) Chemical compounds were dissolved in water, and different proportions of hydrochloric acid added, and then distilled over a water-bath at 100°, or in a vacuum at 15° or 30°. By these methods the action of hydrochloric acid on many salts has been examined. The list includes various nitrates, tartrates, citrates, chromates, antimoniates, hypochlorites, sulphates, permanganates, ferrocyanides, oxalates, &c., in all about thirty salts.

The next paper was "*On the Action of Oxides on Salts (Part I.),*" by E. J. Mills, D.Sc., and D. Wilson. It was read by the Secretary. The object of the present research is to determine the law, in consequence of which the action of oxides on salts leads in general to the formation of other oxides derived from the salts in question. The authors have investigated at present the action of tungstic, silicic, and titanic oxides on potassic carbonate at a high temperature by determining the loss of weight (from the escape of CO_2) during ignition. The reactions have been studied with great care, and corrections for various errors carefully made. The authors give several formulæ deduced from their experimental results. One of the results arrived at is that the chemical effect of an oxide and a carbonate acting on one another under the conditions specified is directly proportional to the product of their active masses, and inversely proportional to the sum of their residues. The authors conclude their paper with the following inference:—"That Brodie's fundamental equation represents the mutual action of two bodies under unit conditions, apart from change of weight, and with the unit of chemical effect."

The next paper was read by Dr. Senier, "*On a New Test for Glycerin,*" by A. Senier, M.D., and A. J. G. Lowe. This test is founded on the fact observed by Iles that borax when treated with glycerin gives to a Bunsen flame the green colour characteristic of boracic acid. The test is thus applied by the authors. The solution is rendered slightly alkaline by dilute soda, and a borax bead placed in it for a short time. The bead is then held in a Bunsen flame. If the solution contains 1 per cent of glycerin a distinct reaction is observed (erythrite and glycol give the same colour), or a little of the solution is mixed with some powdered borax, and some of the mixture placed on a platinum loop, and heated as before. By means of this test, after concentration, &c., one-tenth of a per cent of glycerin was detected in beer; 1 per cent in sherry; 1 per cent in milk; 5 per cent in treacle.

During the reading of the last papers Mr. Warington occupied the chair.

The last paper was read by G. S. Johnson, "*On Ammonium Tri-iodide.*" The author has prepared this substance—(1) By dissolving iodine to saturation in a strong aqueous solution of ammonium iodide; and (2) by stirring crystals of ammonium iodide and iodine with a small quantity of water till the resulting black liquid refused to dissolve more of either ingredient. The liquid was evaporated over sulphuric acid, and in a few days crystallised. No iodide of nitrogen was formed. This substance is more stable than the corresponding potassium salt. NH_4I_3 crystallises in dark blue prisms, usually tabular and isolated. It is soluble in a small, but decomposed (with deposition of iodine) by a large quantity of water; slightly deliquescent; when heated loses iodine, and becomes coated with NH_4I without fusing. Specific gravity of crystals, 3·749; atomic volume, 103·07.

Specimens of the alkaloids obtained by Wright and Luff and of ammonium tri-iodide were exhibited; also some combustion furnaces from Messrs. Bel.

After the thanks of the meeting had been given to the authors for their respective papers, the Society adjourned to June 20.

PHYSICAL SOCIETY.

June 8, 1878.

Prof. W. G. Adams, President, in the Chair.

The following candidate was elected a member of the Society:—Mr. R. H. Solly.

The Secretary read a paper by Prof. Hughes "*On the Physical Action of the Microphone.*" That instrument renders it possible to introduce into an electrical circuit an electrical resistance which varies in exact accord with sonorous vibrations, so as to produce an undulatory current of electricity from a constant source whose wave-length, height, and form is an exact representation of the sonorous waves. Prof. Hughes has found that when an

electrically conducting matter in the form of powder, filings, or superposed surfaces, is put under a certain slight pressure, far less than that which would produce cohesion, and more than would allow it to be separated by sonorous vibrations, a remarkable state of things occurs, the electrical resistance being caused to vary by re-arrangements as regards the form, number in contact, or pressure of the molecules. It is essential that the instrument be so arranged as regards pressure between the touching surfaces as to be adapted to the particular vibrations employed: thus a box suitable for a man's voice is not adapted to observe the tramp of a fly. But in all cases a perfect undulatory current can be secured throughout a certain range; and when speaking to the instrument a galvanometer should be interposed in the circuit, and the pressure between the surfaces gradually increased from a minimum until the needle remains stationary, when a maximum of loudness will be attained. Beyond this point the sounds die out gradually until there is complete silence. Prof. Hughes then proceeded to consider the probable cause of the observed phenomena, taking as an illustration the very simplest form of instrument—two blocks held together by an insulated adjusting-screw, the lower block being fixed to the board by means of which it receives the sonorous vibrations. From numerous experiments he inclines to the belief that the whole block increases and diminishes in size at all points, both in the centre and at the sides, in accordance with the form of the sonorous wave, and that this increase in size varies the resistance by changing—(1) The pressure at the surface of discontinuity; and (2) the extent of the molecular surfaces in contact. Of these changes he considers the latter has the greatest effect, since some of his best results have been obtained by using two surfaces of solid gold, and not by such an elastic conductor as metallised silk, which would be most affected by the first-named change. As evidencing the great mechanical effect produced by this uprising of the molecules, he mentioned that, when a large musical box was playing, one ounce of lead did not suffice to maintain two surfaces of 1 square c.m. in contact until the box was placed several feet distant. Prof. Hughes is now mainly anxious to find some efficient insulator for sounds, as, until such is available, it will be impossible to isolate and study many objects which require investigation from this new point of view. Prof. Hughes himself then exhibited some of the remarkably simple appliances he has used in his investigations. A very small clock, placed on a small drawing-board which carried a microphone, was used to interrupt a current passing through a telephone, and the tick was immediately audible through the whole room. A very remarkable effect was then shown. The microphone attached to this board being still connected with the telephone, which, being provided with a bell-mouth, enabled the audience to hear the sounds produced, a second telephone was introduced into the circuit and laid on the board, when a continuous sound was at once produced. This, Prof. Hughes explained, would last as long as the battery continued in action, and its explanation is as follows:—The act of placing the telephone on the board set up a vibration in the microphone; this passing to the bell-mouthed telephone set the second telephone in action, was returned to the board, and again passed, through its action, to the microphone. Hence the action is self-supporting, and it solves in a most perfect manner the question of a relay for the human voice in telephony; for it becomes only necessary to provide such an arrangement at each station for a speech to be both received and transmitted to any number of succeeding stations. The system is perfectly duplex, for if two correspondents speak into microphones and use telephones for receiving, each can hear the other, but his own speech is inaudible, and if each sing a different note no chord is heard. Experimenting on deaf persons, he finds that they can be made to hear the tick of a watch but not human speech, and his results have led him to conclude that we only hear ourselves speak through our bones and not through our ears. Finally, Prof. Hughes illustrated Sir Henry Thompson's method of probing for shots, splinters, &c., by finding a very small shot in the midst of a piece of wash-leather.

Sir John Conroy, Bart., M.A., read a paper "*On the Light Reflected by Potassium Permanganate.*" After referring to the results obtained by Haidinger and Stokes, and more recently by Weidemann, he proceeded to describe his own experiments, which have been made by means of a very complete Babinet's goniometer provided with a vertical as well as a horizontal stage, so that the reflecting surface could be placed directly over the axis of the instrument. Sunlight unpolarised or polarised in any plane by a Nicol was used, and the moving arm of the instrument carried a direct-vision spectroscope with a "bright-spot" micrometer and a reflecting-prism for bringing a second spectrum into the field. The colour of a surface, obtained by rubbing the crushed permanganate into a surface of ground glass with an agate burnisher, was found to vary with the nature of the light and its angle of incidence, and it further varied as the surface was immersed in benzene, bisulphide or tetrachloride of carbon. With light polarised perpendicular to the plane of incidence the dark bands in the reflected spectrum are far more distinct than when unpolarised or polarised perpendicularly to that plane. In the first of these three cases four bands are observed at angles less than 40°, and the blue end of the spectrum is very weak. As the angle of incidence increases the intensity of the blue rays diminishes; the dark bands gradually shift towards the blue end of the spectrum, and at about 60° a new band appears near D. With a still greater angle more of the blue rays are reflected and the bands fade away, those in the more refrangible part disappearing first. This displacement amounts approximately to 0·006 tenth-metre.

Prof. S. P. Thompson exhibited and described a cheap and efficient form of optical bench. Two straight oak bars, about 2 metres in length, are clamped together as in a lathe-bed, and a number of slides carrying various appliances slide easily without shake, and can be fixed in any position by wedges. The several frames carrying the diffraction grating or edges, the eye-piece (with an engraved glass micrometer), &c., are so made, in wood, as to be capable of adjustment in any plane, and the instrument can also be employed for making photometric and other similar measurements. The mean of two determinations for the wave-length of certain red light gave 0·000629 as compared with Fresnel's figure, 0·000640, while the total cost did not exceed £3.

The Secretary then read a paper by Prof. Ayrton, of the Imperial College of Tokio, Japan, "*On the Electrical Properties of Bees'-wax and Lead Chloride.*" The index of refraction of the former substance increases in passing from the liquid to the solid state, and it therefore seems important, in connection with the electro-magnetic theory of light, to carefully measure the specific inductive capacity of a condenser made of wax as it is cooled through its solidifying-point. The rise in capacity as the temperature falls from 80° to 60° C. is very striking, and the entire change was found to be in exact agreement with the changes known to occur in the index of refraction for light. An elaborate series of experiments was made, which sufficed to show that the results obtained were not due to any change in the distance apart of the plates (of copper) between which the wax was placed, caused by any shrinkage of this wax on solidifying. In consequence of a remark of M. Buff that lead chloride behaves as a metal, Prof. Ayrton has studied it as a dielectric, and he found a diminution of resistance by electrification; but as this result was not confirmed on subsequent experiment the question was more fully investigated, when he found that with an electromotive force under 1·75 volts. there is an increase in resistance, and above that amount there is a regular or irregular diminution. This limiting force is about that required to decompose water, and he concludes that the results obtained must be due to the damp contained in the lead chloride.

NOTICES OF BOOKS.

Water Supply of the State of New Jersey. Report by the Committee on Water Supply read at Meeting of New Jersey State Sanitary Association, held at Peinceton, October 17th, 1877. By Albert R. Leeds, Chairman. Reprinted from the *Journal of the Frankland Institute* for March and April, 1878. Philadelphia: W. P. Kildare.

We have yet much to learn concerning water. We refer of course not so much to the hydric oxide of the chemist, —a conception almost as absolutely ideal as the lines and points of the mathematician,—but to water as it actually exists in Nature, and still more in places where Nature has given way to human improvement; water holding in solution variable but important proportions of foreign matter, organic and inorganic, dead and living, and exercising no small influence upon animal life and upon man himself. We have yet, in great part, to discover when and why the streams and wells in any given region are unwholesome, and how any injurious properties are to be detected. We know, of course, that to make our streams the channels for removing excreta, animal and human, along with the varied refuse of industrial operations, is necessarily and indisputably evil. There are rivers—such as the Irwell, the Calder, the Aire, or the Sankey—which require no chemical examination to ensure their rejection for domestic purposes by any sane person. But there are waters inoffensive to man's senses which analysis pronounces suspicious. There are others which on scientific grounds appear doubtful, and which, sometimes used with impunity on other occasions, prove pernicious, and even deadly, if not to man, yet to cattle or to fish. Thus a paragraph is at present "going the round of the papers" concerning certain poisonous lakes in the interior of Australia, which, if drank by horses or oxen, generally prove fatal. These lakes certainly receive no manufacturing refuse, no drainage from cesspools or sewers; they contain, doubtless, as do woodland pools generally, a considerable proportion of decomposing vegetable matter; but why do their waters exert so peculiar and specifically destructive an action?

Again, it is stated that in certain rivers of Scotland, and we believe of Cumberland also, an unexplained disease has appeared among the salmon, which are dying off in multitudes, to the great discomfiture of the riparian proprietors, of the angling fraternity, and of all lovers of fish. The salmon are attacked by a whitish fungoid growth, which appears first in the head, then in the tail, and finally on the fins. We can scarcely believe that the rivers in question have since 1877 received any pollution, either novel in kind or increased in quantity. The general dulness of manufactures and the increased vigilance of the authorities concerning the pollution of rivers all point rather in the opposite direction. What, then, can be the cause of this sudden epizootic?

A similar mortality occurred during last summer among the fish in the Passaic, to the no small alarm of the population using the waters of this river for domestic purposes. From a careful consideration of the circumstances of this disease, Prof. Leeds concludes that it was due not to the poisonous dye-wares, acids, &c., but to an abnormal development of vegetation of a low type, favoured by the unusually low temperature and the prolonged drought. He suggests that such vegetable growths may produce substances which act upon fishes as specific poisons, and that by their decay the water may be deprived of the supply of dissolved oxygen necessary for the life of the fish. This hypothesis seems to us to carry with it a strong amount of probability, but before it can be regarded as established no small quantity of chemico-biological research will be required. Such investigations will be of the utmost importance to sanitarians. Much good might result if the methods used in this country for the determination of the organic impurities of waters were supplemented by those recommended by M. Gerardin in a memoir crowned by the Académie des Sciences. His three principles are—1. A determination of dissolved oxygen by the "hydrosulphite" process (Schützenberger and Gerardin's). 2. An observation of green plants and aquatic Mollusca. 3. A microscopic examination of Algæ and Infusoria. The results of these three methods of examination are said to be concordant. A clear water, inhabited by fishes and supporting such plants as the water-cress, was found comparatively rich in oxygen. Where oxygen is deficient the higher forms both of animal and vegetable life disappear, and in their place are found organisms of low type. This process appears to have its well-marked gradations. Thus above Rheims the River Vesle was clear, abounding in fishes, charas, water-cress, iris, &c., and containing 1 cubic inch of oxygen per cent. As soon as it received the refuse of some dye-works in the suburbs of Rheims, fish and water-cress disappeared, and in their stead came *Sparganum simplex*. After the influx of the principal sewers of Rheims the oxygen had fallen to 0·05 cubic inch. Two Algæ, *Beggiatoa alba* and *Oscillaria natans*, were largely developed. At Macan the oxygen had increased to 0·74 cubic inch, and a whitish Alga known as *Hypheothrix* covered the bed of the river. At Compensé this, too, had ceased, and the *Sparganium simplex* flourished again. Following the stream still farther, the increase in the amount of oxygen and the change in the vegetation were simultaneously progressive; and at Braisne the water contained again 1 cubic inch of oxygen per cent, whilst fish and water-cress flourished just as they did above Rheims. Thus in the course of 37½ miles a river was observed to be clean, polluted, and clean again, its purification having been effected by natural agencies. The various stages of pollution were marked by the successive appearance of *Sparganium*, *Spirogyra*, *Hypheothrix*, *Beggiatoa*, and *Oscillaria*, and the progressive steps to improvement by their reappearance in an inverse order.

Our author quotes also, from Prof. W. G. Farlow, some interesting remarks on the development of Algæ in polluted waters, especially *Beggiatoæ*, *Oscillariæ*, *Anabænæ*, &c., which give off most offensive odours: that of *Plectonema*, when decaying, is compared to the smell of a pigsty. Prof. Leeds very justly remarks that these investigations concerning the fresh-water Algæ, and their connection with and inter-dependence upon the animal life of streams and upon their dissolved oxygen, are of great importance. Upon them the solution of many unsolved problems of water-pollution and water-purification largely depends."

In conclusion, the author gives it as his opinion that, "whilst admitting the great value of the albuminoid ammonia process in many cases, yet there is much reason to believe that an organic analysis of the residue affords a safer ground of comparison." We are not absolutely satisfied with either process, and think that a fully satisfactory method of water-analysis lies still hid in the future. Prof. Wanklyn has, indeed, made some recent discoveries concerning the determination of organic matter dissolved in water; but as he has taken the extraordinary step of protecting his new process by a patent, the chemical public must wait for six months before the details become known, and in all probability for fourteen years before the method can receive that thorough and practical scrutiny which can alone decide upon its merits.

The pamphlet of Prof. Leeds, brief as it is, must be pronounced a weighty contribution to sanitary science.

Handels-Bericht vom Monat April, 1878, *von Gehe & Co., in Dresden.* (Trade Report for the month of April, by Gehe and Co., of Dresden.)

A very carefully prepared and useful trade-list of drugs and chemicals, to which is prefixed an elaborate dissertation on the present chronic depression of trade and its causes.

A Key to Organic Materia Medica, &c. By Dr. JOHN MUTER, M.A., F.C.S., Director of the South London School of Pharmacy. Second Edition. Simpkin and Marshall. 1878.

THE second edition of Dr. Muter's excellent manual is a vast improvement on the first, which was issued some four years back. The work has been enlarged from 140 to 480 pages, and contains everything that an ordinary student should know, and much more. As an introduction to Hanbury and Flückiger's "Pharmacographia" it will be found of great service to those pharmacists—and there are many of them—who wish to acquire a deeper knowledge of Materia Medica than is required by the magnates of Bloomsbury Square. The former work was simply a descriptive catalogue of Dr. Muter's own museum, the arrangement being in accordance with the contents of the drawers to be examined by his students. This method of classification has been entirely done away with, and the different products are now described in their botanical and zoological order. The source, method of collection, description, uses, chemistry, and pharmacology of each substance are given in clear and concise terms, which shows the practised teacher. Dr. Muter's method of observing, measuring, and classifying starches as given in the Appendix is an excellent one. The book is printed in large legible type, and the index, which has been compiled by Mr. Joseph Ince, is particularly copious, and would have pleased even the late Lord Campbell. We can highly recommend this work to our pharmaceutical readers.

The Mineralogical Magazine, &c. Vol. II., No. 8. Simpkin and Marshall. March, 1878.

THIS excellent magazine—which, in addition to much other interesting matter relating to the collection and classification of minerals, contains the *Transactions* of the Mineralogical Society—has a capital number for the beginning of the new volume. The papers by Mr. Sorby, the President of the Society, "On the Determination of the Minerals in their Sections by their Indices of Refraction;" by Professor Bonney, "On the Gabbro of the Pennine Alps," and the beginning of a series by Professor Heddle "On the County Geognosy and Mineralogy of Scotland," may be read with interest and profit by both the chemist and the mineralogist. We are glad to see that the Mineralogical Society is in a very flourishing condition. Two plates accompany each number, the date of issue being at intervals of about three months, the last number having appeared in March.

CORRESPONDENCE.

ANALYSES OF RUSSIAN IRON.

To the Editor of the Chemical News.

SIR,—Mr. E. Riley remarks (CHEM. NEWS, vol. xxxvii., p. 226) that he is astonished that most of the steels the analyses of which appeared in my late paper (CHEM. NEWS, vol. xxxvii., p. 199) contain only traces of Ph and S. He also remarks thai the percentage of Mn is too low (unusually?) in the analyses, and that I perhaps use inferior methods for the detection of Ph, S, and Mn.

The following are my answers:—

1. The steels in question were prepared from Oural pig-irons; most of them, indeed, contain only *traces* or *nil* of Ph and S. Charcoal is used as a fuel.

2. The methods I use belong to Eggertz, and may be found in his classical manual "Om Kemisk profning af Jern, Jernmalmer och Braenn materialier." Using the methods of the well-known professor, V. Eggertz, I cannot understand why I should prefer other methods.

3. As for the low percentage of Mn, I will only mention that I cannot understand what Mr. Riley wishes, as it is not my fault that the Russian steels contain such a low percentage of Mn.—I am, &c.,

SERGIUS KERN, M.E.

St. Petersburg, 48, Rue aux Pois,
June 7, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

NOTE.—All degrees of temperature are Centigrade, unless otherwise expressed.

Bulletin de la Societe Chimique de Paris, No. 6, March 20, 1878.

Solubility of Certain Organic Acids in Alcohol and Ether.—E. Bourgoin.—It is maintained that tartaric acid is insoluble in ether, whilst the organic acids most nearly approaching it are soluble in that liquid. The author having found that this exception does not exist, has compared the respective solubilities in alcohol and ether of the following acids:—Oxalic, succinic, tartaric, citric, gallic, benzoic, salicylic, and phthalic. His results are embodied in the following table:—

Acids.	Ether.	Absolute Alcohol.	Alcohol at 90 per cent.
Oxalic	1·266	23·730	14·700
Succinic	1·265	7·510	12·590
Tartaric	0·400	25·604	41·135
Citric	2·260	75·900	52·850
Gallic	2·560	38·790	23·310
Benzoic	31·350	46·680	41·620
Salicylic	50·470	49·630	42·090
Phthalic	0·684	10·080	11·700

Synthesis of Phthalic Acid.—A. Guyard.

New Method of Precipitating the Gold contained in Old Toning-Baths.—F. Haugh.—The baths when no longer fit for use are filtered into a white glass flask, rendered alkaline with a little bicarbonate of soda, and a concentrated alcoholic solution of magenta is added drop by drop until the liquid has taken the deep red hue of syrup of raspberries. The flask is then exposed for six to eight hours to the light of a bright window. At the end of this time the gold is found to be deposited as a violet powder, whilst the supernatant liquid has become colourless. It is carefully decanted, so as to preserve merely the deposit. When a sufficient quantity of protoxide of gold has thus been collected, it is carefully washed upon a filter, dried, and the filter is burnt. The dry residue and the ash of the filter are then dissolved at a gentle heat in an excess of *aqua regia*, and the solution—diluted with distilled water—is separated from the insoluble substances by filtration.—*Chem. Centralblatt*, viii., 201.

Process for the Preparation of Guignet's Green.—A. Scheurer-Kestner.—Analysis having shown that Guignet's green is merely a hydrate of chrome formed by the decomposition of a chromo-potassic borate in the presence of water, the author has sought to produce a simple chromic borate in the hope of forming Guignet's green by its decomposition. On igniting a mixture of ordinary chromic hydrate and boric acid in the proportion of five to six parts of the crystalline acid to one part of the anhydrous chromic oxide a green, partially fused mass is obtained. This mass, on contact with water, becomes heated, and is resolved into hydrated oxide (Guignet's green), which is precipitated, and boric acid, which is dissolved. Theoretically, this experiment has a certain importance, since it establishes with certainty that potash plays no part in the ordinary process.—*Bull. de la Soc. Indus. de Mulhouse.*

No. 7, April 5, 1878.

Dissociation of Sulphides in Presence of Boiling Water, as well as at Temperatures below 100°.—MM. de Clermont and de Frommel.—The authors find that certain hydrated sulphides on boiling are dissociated into hydric sulphide on one hand and oxide on the other. This phenomenon has been observed in case of most sulphides, with the exception of those of copper, bismuth, and mercury. They have not been able to draw out the general law of this reaction, the transformations of the sulphides in presence of water being very complex. Arsenic trisulphide is dissociated on boiling into hydric sulphide, which escapes, and arsenious acid, which remains in solution. This fact has led them to a new process for the separation of arsenic in presence of other metals, espacially tin, antimony, gold, platinum, and all the other metals whose sulphides are decomposable by boiling water. They proceed as follows :—The mixed sulphides are suspended in water, and raised to a boil. The arsenic sulphide is rapidly disssociated, ebullition for twenty to twenty-five minutes being for 5 to 6 centigrms. of sulphide. All the sulphides except that of arsenic yield insoluble oxides which may be removed by filtration from the soluble arsenious acid, which may then be determined by ordinary methods. The same process is applicable to the separation of arsenic acid.

Composition of the Mineral Waters of Aix, in Savoy, and of Marlioz.—E. Willm.

Composition of the Sulphuro-bromo-ioduretted Waters of Challes.—E. Willm.—Two papers of considerable length, and of medical rather than chemical interest.

Substitution of Sulphur for Oxygen in the Fatty Series.—A. Dupré.—Hitherto only acids have been obtained in which one of the three atoms of oxygen is replaced by sulphur. The author has endeavoured to replace all three.

New Method of Preparing Normal Dimethyl-Ethylen.—MM. Le Bel and Greene.—Normal dimethyl-ethylen is formed in the action of $ZnCl_2$ upon butylic alcohol at elevated temperatures.

Pyrogenous Derivative of Tartaric Acid, Dipyro-tartaric Aceton.—E. Bourgoin.—The author remarks that the dry distillation of this acid has hitherto yielded merely two compounds, the pyruvic and pyro-tartaric. He has succeeded in obtaining a third, of greater molecular complication, which he names dipyro-tartraceton, and which is neutral, very slightly soluble in water, but soluble in alcohol, ether, sulphide of carbon, and chloroform.

Derivatives of Quercite, obtained by means of Hydrochloric Acid.—L. Prunier.—Concentrated hydrochloric acid dehydrates quercite, producing quercitan, or rather its hydrochloric derivatives.

New Colouring Matter derived from Mono-nitro-alizarin, and known as Blue Alizarin.—M. Prud'homme.—Already noticed.

Procedures for the Restoration of Writing Effaced by Time.—E. von Bibra.—The author proposes to moisten the writing with a moderately concentrated solution of tannin, the excees of which is then removed by the application of the washing-bottle, and the paper dried at 65°.

Process for Seasoning New Casks.—E. von Bibra.—The author proposes to eliminate all soluble matter from the interior of the staves by the use of crystals of soda, of which 1 kilo. is used per hectolitre of the contents. The cask is first filled two-thirds full of clean water, the proper quantity of solution of soda is added, and after the liquid is mixed the cask is filled to the bung. After standing for ten or twelve days the alkaline liquid is run out, and the cask repeatedly rinsed with clean water.

New Discharge for Vat-Blues.—Oscar Scheurer.—The author prints on minium, and passes through weak hydrochloric acid, thus obtaining white designs very clear and well defined. Chrome-yellow, vermilion, Guignet's green, or other insoluble colours, thickened with albumen, may be associated with the minium.

Conversion of Magenta into Aniline-Violet.—M. Vaucher.—The author observes that magenta dissolved in aldehyd takes on standing a violet-shade, the change at common temperatures going on for two months.

Certain Artificial Colouring Matters Fixed by means of Sulphur.—M. Vaucher.—The author finds that wool boiled in a solution of sodic hyposulphite in presence of sulphuric acid not merely attracts aniline-green, but gives fuller and brighter shades, with a number of artificial colours, among which are mentioned eosin, aniline-brown. phosphine, safranin, aniline-violet, &c.

———

Justus Liebig's Annalen der Chemie, Band 191, Heft 3.

Ethylenlactic Acid.—E. Erlenmeyer.—The author has not succeeded in obtaining the ethylenlactic acid of Wislicenus, either by the processes given by that author or by Linnemann's method.

Researches on the Compounds Occurring in Crude Anthracen.—Dr. Othmar Zeidler.—In experimenting with a supposed pure material the author obtained results indicating that in addition to the well-known and more plentiful compounds, other substances were present which adhere obstinately to anthracen. In order to separate these compounds he had recourse to the action of solvents and fractionated crystallisation. The procedure adopted was a twice repeated extraction of the anthracen with water acidulated with sulphuric acid, in order to remove acridin. The residue was dried, extracted at an ordinary temperature with five-fourths of its weight of acetic ether, pressed, digested again with the same quantity of acetic ether, and the residue after pressure was washed upon the Bunsen pump with the same quantity of the solvent till the liquid running off was merely slightly yellow. Of the original 400 grms. 235 were dissolved. The acetic ether was then distilled off, and the residual brown cake submitted to distillation. The portion insoluble in acetic ether consists essentially of anthracen, along with chrysen and other bodies, and it has as yet not been submitted to further examination. The portion dissolved in acetic ether was next treated as follows :—It was extracted with warm alcohol at 40°, let cool, and filtered (filtrate No. 1). The residue was treated in a similar manner with benzol (filtrate No. 2). The residue was treated with a minimum of hot benzol and filtered without cooling (filtrate No. 3), whilst the residue upon the filter was marked No. 4. No. 1 contains carbazol, phenanthren, fluoren ; No. 2 contains synanthren ; No. 3 anthracen and pseudophenanthren, whilst the portion insoluble in benzol consists of carbazol. From the latter the author obtained a new derivative, nitroso-carbazol, which dissolves in sulphuric acid with a dark green colour, which, on the application of heat (100°), becomes a blue-green, whilst nitrous acid escapes. On the addition of water a dark green precipitate falls, partially soluble in water with a green colour, the solution turning to a dirty violet in presence of an alkali.

Speed of Molecules.—Fr. Wächter.—A mathematical paper, not suitable for abstraction.

Aniluvitonic Acid.—Dr. Carl Böttinger.—The author assigns to free aniluvitonic acid the formula $C_{20}H_{18}N_2O_4$.

Didymium and Lanthanum.—F. Frerichs and F. Smith.—The authors give their reasons for regarding these two metals as trivalent elements, and describe a great number of their salts.

Behaviour of Acrylate of Soda with Aqueous and Fused Alkaline Bases.—E. Erlenmeyer.—Acrylate of soda at the melting-point of dry hydrated potassa is not carbonised, but resolved into an acetate and a formiate.

Behaviour of Acetylen with Concentrated Sulphuric Acid.—Simon Zeisel.—From this investigation it appears that Lagermark and Eltekoff were in error when they believed that they had converted acetylen into crotonic aldehyd.

Biedermann's Central-blatt, Heft 12.

Organic Substances Capable of Producing Putrefaction in Water.—Prof. Gustav Bischof.—Taken from the CHEMICAL NEWS.

Absorptive Power of Soils.—Dr. W. Pillitz.—The quantities of potash and ammonia which are capable of being absorbed by the same quantity of the same soil are in proportion to the equivalents of these compounds. When earth saturated with sal-ammoniac was treated with solution of phosphate of potash, the absorption of the potash was affected, but not that of the phosphoric acid.

Disengagement of Oxygen from Green Twigs Submerged in Water Previously Boiled and Exposed to the Sun.—Prof. Jos. Böhm.—If fresh green shoots of *Ligustrum vulgare* are exposed to the sun-light under water previously boiled, they evolve much more oxygen than corresponds to the quantity of air contained in them before the experiment. This oxygen is chiefly derived from the carbonic acid thrown off from the substance of the twigs in consequence of internal respiration. On prolongation of the experiment, the development of gas becomes slower and slower, and ceases entirely in three or four days, although the shoots still appear fresh and healthy. If the same twigs are again exposed to the light in a fresh portion of boiled water, they merely give off at first a few bubbles of gas, and if the experiments are continued above a week, the green rind turns brown, and carbonic acid and hydrogen are evolved in consequence of butyric fermentation.

Ripening Process of Grapes.—E. Mach, Fr. Kurmann, and A. Schultz.—Mach concludes that the weight and diameter of grapes increase at first rapidly, till the time for the change of colour is near, after which the increase becomes slow. The absolute percentage of sugar increases at first slowly, but becomes rapid when the colouration begins. The quantity of free acid increases at first, but from the moment of incipient colouration, it decreases, both relatively and absolutely. Tannin is relatively most abundant at first, and disappears almost entirely at the time of colouration. Starch disapears on ripeness.

Deceptive Colouration of Wine with Magenta.—It is contended that wines containing even the smallest traces of aniline or phenol colours should be confiscated.

Reimann's Färber Zeitung, No. 18, 1878.

The hygroscopic property of cobalt chloride is utilised in a style of handkerchiefs now sold as "Foulard's baromètre." The design is a man carrying an umbrella, the latter being printed in chloride of cobalt. If the weather is fine and dry the umbrella appears blue, but turns grey on unsettled days, and becomes white in rain. The first washing removes the colour.

A variety of magenta has been introduced, which is quite unaffected by contact with acids.

Malachite green is a new dye, discovered by Dr. Oscar Döbner, and formed by the action of benzotrichloride upon methyl-aniline in presence of metallic salts. The colour in question is the only product of the reaction. It is calculated to be a very formidable rival to methyl-green, as it does not, like the latter, change its colour on the application of a boiling heat.

Les Mondes, Revue Hebdomadaire des Sciences, No. 1, May 2, 1878.

Remarks on the Radiometer.—M. Riecke.—The author establishes the equation of the movement of the radiometer; supposing this movement produced of a constant normal pressure upon the discs, and a friction proportional to the speed. Experiments made with two different radiometers gave for one a constant coefficient of friction, whilst in the other this coefficient increased with the speed. The pressures were respectively measured by 0·00002 and 0·00006 centimetres of water. The author examines the signification of this pressure as regards the emission theory.

On the Radiometer.—Prof. Cooke.—All the movements of the radiometer are explained by the theory of gases, without having recourse to any other hypothesis. The author caused to fall upon an ordinary radiometer, a beam of parallel rays, so as to illuminate the black surface alone, the white surface alone, or both together. The number of revolutions in the same time is 233, 88, and 319, the last number being evidently the sum of the two others. The movement is, therefore, produced by interior forces. Heating the glass globe gives a negative rotation. The radiometer may be regarded as a thermic machine; the black surface being the generator, and the case the refrigerant. He compares the intensities of two flames, the one luminous and the other non-luminous, placed successively at equal distances from a radiometer and a thermo-electric battery. The battery showed 0·311, and the radiometer 0·315. The movement is, therefore, an effect of heat.—*Sill. Journal*, xiv, 1877).

No 2, May 9, 1878.

Prof. Ricard, of Trchewan, apparently in Bohemia, describes an instance of the spontaneous rupture, or rather explosion, of a child's drinking-cup of toughened glass. The *Polytechnisches Notizblatt* adds that several such cases have lately occurred without any perceptible cause.

MEETINGS FOR THE WEEK.

TUESDAY, 18th.—Royal Institution, 3. "Minute and Low Forms of Life," Rev. W. H. Dallinger.
— Zoological, 8.30.
WEDNESDAY, 19th.—Geological, 8
— Meteorological, 7.
THURSDAY, 20th.—Royal 8.30.
— Chemical, 8. "Contributions to the History of Naphthalene: II. β-Naphtha-quinon Derivatives," J. Stenhouse and C. E. Groves. "On Pyro-tri-tartaric and Carbo-pyro-tri-tartaric Acids," G. Harrow. "Laboratory Notes," H. E. Armstrong. "Octylie Alcohol and its Derivatives," E. Neison.
— Philosophical Club, 6.30.
SATURDAY, 22nd.—Physical, 3. "Experiments with a New Polariscope," Prof. W. G. Adams. Starch and Unannealed Glass under the Polariscope," W. Baily. Equipotential Surfaces of a Conductor under Influence," Sir Frederick Elliott. "Complementary Colours," Dr. Gorham. "Flow of Water from Orifices at Different Temperatures," Prof. W. C. Unwin. "Co-ordination of Space," C. H. Hinton. "Magnetic Figures Illustrating Electro-dynamic Relations," Prof. S. P. Thompson.

NOTES AND QUERIES.

Writing Fluid.—I should be very glad if you would furnish me with a recipe for good writing-fluid—one that writes violet, and quickly changes to a deep black, that flows freely, and does not corrode steel pens.—H. Ross.

Testing Lemon Juice.—Can any of your readers inform me where I shall find a simple method of testing lemon juice intended for calico-printers' use to determine its genuineness? The citrometer of course gives the specific gravity, which is usually taken as an indication of the amount of citric acid present, but it seems that it may be considerably adulterated with other juices and acids, which render it undesirable for printers.—A DRYSALTER BUT A POOR CHEMIST.

THE

INSTITUTE OF CHEMISTRY OF GREAT BRITAIN AND IRELAND.

Incorporated on the 2nd October, 1877, under the 30th and 31st Victoria, chap. 131, sec. 23.

LIST of OFFICERS and COUNCIL.

President—E. FRANKLAND, Ph.D., D.C.L., F.R.S , &c.

VICE-PRESIDENTS.

F. A. Abel, C B., F.R.S.
Alexander Crum Brown, M.D., D.Sc , F.R S.E.
Robert Galloway, M.R.I.A., F.C.S.
William Odling, M A., M.B., F.R.S.
R. Angus Smith, Ph.D., F.R.S.
AugustusVoelcker, Ph.D., F.R.S., F.C.S.

Treasurer—C. R. Alder Wright, D.Sc., F.C.S.

ORDINARY MEMBERS of COUNCIL.

John Attfield, Ph.D., F.C.S.
James Bell, F.C.S.
Dugald Campbell, F.C.S.
Michael Carteighe, F.C.S.
W. Crookes, F.R.S., V.P.C.S.
G. E. Davis, F.C.S.
Warren De la Rue, D.C.L., F.R.S.
William Dittmar, F.R.S.E., F.C.S.
A. Dupre, Ph.D., F.R.S., F.C.S.
R. J. Friswell, F.C.S.
J.H.Gladstone, Ph D., F R.S.
George Gore, LL.D., F.R.S.
W. N. Hartley, F.R.S.E., F.C.S.
Douglas Herman, F.C.S.
David Howard, F C.S.
C. T. Kingzett, F.C.S.
A. F. Marreco, F.C.S.
F. A. Manning, F.C.S.
E. J. Mills, D.Sc., F.R.S.
E. Neison, F.C.S., F.R.A.S.
John Pattinson, F.C.S.
T. Redwood, Ph.D., F.C.S.
J. Emerson Reynolds, M.D., M.R.I.A., F.C.S.
Thomas Stevenson, M.D., F.C.S.
R. R. Tatlock, F.R.S.E., F.C.S.
R. V. Tuson, F.C.S.
J. T. Way, F.C S.

Solicitor—Jas. Pettingill, 32, Walbrook, E.C.
Secretary—C. E. Groves, F.C.S.
Offices—Somerset-house-terrace, S.W.

This Institute has been established to ensure that Consulting and Analytical Chemists are duly qualified for the proper discharge of the duties they undertake by a thorough study of Chemistry and allied branches of Science in their application to the Arts, Public Health, Agriculture, and Technical Industry.

The Council of the Institute requires satisfactory evidence as to training and fitness for the work of the Consulting and Analytical Chemist to be produced, before admitting any person to the rank of a Fellow, and an examination is imposed whenever the Council deems it necessary. Fellows must be at least 24 years of age.

A Grade of Associates of the Institute has been formed, and the present Regulations require every applicant for admission to this Grade to submit to a stringent examination in Practical Chemistry, and to show to the satisfaction of the Council that he has passed through a course of three years' study of Theoretical and Analytical Chemistry, Physics, and Elementary Mathematics.

An Associate must be at least 21 years of age before admission, and is not eligible for the higher rank of Fellow until he has been continuously engaged for three years in the study and practical work of applied Chemistry, in a manner that shall be considered satisfactory by the Council.

FELLOWS.

Abel, F.A., C.B., F.R.S., Royal Arsenal, Woolwich, S.E.
Abney, Capt. W. W., 3, St. Alban's-road, Kensington, W.
Ackroyd, William, 56, Walton-street, Chelsea, S.W.
Acworth, Joseph J., F.C.S., Oakville-house, Gravesend
Aitkin, Andrew P., D.Sc., Edinburgh
Alldred, C.H., F.C.S., 24, Duke Street, Grosvenor-square, W.
Allen, Alfred H., F.C.S., 2, Collegiate-crescent, Sheffield
Allison, Thomas, Stockton-on-Tees
Angell, John, F.C.S., Grammar School, Manchester
Angell, Arthur, Public Analyst, Southampton
Appleyard, Gilbert C.W., Prestolee, near Manchester
Armstrong, H.E., Ph.D., F.R.S., London Institution, E.C.
Atkinson, Edmund, Ph.D., F.C.S., Portesbury-hill, Camberley
Atkinson, R.W., D.Sc., F.C.S., University of Tokio, Japan
Attfield, John, Ph.D., F.C.S., 17, Bloomsbury-square, W.C.

Baker, William, F.C.S., 46, High-street, Sheffield
Bannister, Richard, F.C.S., Laboratory, Somerset-house, W.C.
Barff, Frederick S , F.C.S., 100, Abbey-road, Kilburn, N.W.
Barnes, Joseph, Dyke Nook, Accrington
Barret, E. L , B.Sc., F.C.S., 53, Springfield-road, N.W.
Bassett, Henry, F.C.S , 44, St. Paul's-road, N.W.
Baynes, James, jun., F.C.S., Kingston-upon-Hull
Bean, C.E., F.C.S., Brooklyn-house, Shepherd's-bush, W.
Bell, J. Carter, F.C.S., Kersal Clough, Manchester
Bell, James, F.C S., Laboratory, Somerset-house, W.C.
Bell, William Gomm, 52, Duchess-road, Birmingham
Bickerdike, W.E., F.C.S., Surbiton-place, Blackburn
Bischof, Gustav, F.C.S., 4, Hart-street, W.C.
Bourchier, C.E., Messrs. Birdley and Co., Burton-on-Trent
Bowdler, Arthur Clegg, Blackburn
Bowrey, James John, F.C.S., Kingston, Jamaica
Brazier, James Smith, F.C.S., University, Aberdeen
Brock, John, British Alkali Works, Widnes, Lancashire
Brown, A. Crum, F.C.S., 8, Belgrave-crescent, Edinburgh
Brown, Adrian John, F.C.S., Burton-on-Trent
Brown, E. Ormond, F.C.S., Royal Arsenal, Woolwich, S.E.
Brown, James Campbell, D.Sc., F.C.S., Liverpool
Brown, Horace T., F.C.S., Burton-on-Trent
Bruce, A. C., M.A., F.C.S., King Edward School, Birmingham
Buchanan, John Young, F.R.S.E., 10, Moray Place, Edinburgh
Bullock, J. Lloyd, F.C.S., 3, Hanover-street, W.
Burge, Charles H., Laboratory, Somerset-house, W.C.
Burghardt, C. A., Ph.D., Owens College, Manchester
Butterfield, J. C., F.C S., 106, Queen Victoria-street, E.C.

Calderwood, John, Addiewell, West Calder, N.B.
Cameron, Charles A., M.D., 15, Pembroke-road, Dublin
Cameron, James, Laboratory, Somerset-house, W.C.
Cameron, J. M., F.C.S., 90, King-street, Hammersmith
Cammack, J., 50, Pecker's-hill, Sutton, near St. Helen's
Campbell, Dugald, F.C.S., 7, Quality-court, Chancery-lane
Carey, Eustace, Widnes, Lancashire
Carteighe, Michael, F.C.S., 180, New Bond-street, W.
Caswell, C. B., F.C.S., 13, George-road, Birmingham
Church, Arthur Herbert, F.C.S., Agricultural College, Cirencester
Clapham, R. Calvert, F.C S., Earsdon, near Newcastle-on-Tyne
Clark, John, Ph.D., F.C.S., 138, Bath-street, Glasgow
Claudet, F., F.C.S., 6 and 7, Coleman-street, E.C.
Cleaver, Edward Lawrence, F.C.S., 289A, King's-road, S.W.
Cleminsbaw, E., F.C.S., King's School, Sherborne
Cloud, Thomas Charles, Wallaroo, South Australia
Clowes, Frank, D.Sc., F.C.S., Newcastle-under-Lyme
Coleman, J. J., F.C.S., 13, Dundas-street, Glasgow
Cooke, Samuel, M.A., Civil Engineering College, Poona
Coomber, Thomas, F.C.S., 80, Kingsdown-parade, Bristol
Corfield, W. H., M.A., M.B., F.C.S., 10, Bolton-row, W.
Cownley, Alfred John, F.C.S., 106, Fenchurch-street, E.C.
Cranston, George, 22, Devonshire-street, Manchester
Crookes, William, F.R.S., V.P.C.S., 20, Mornington-road, N.W.
Crowder, William, 33, Clapton-square, Lower Clapton, E.

Dalziel, John Graham, United College, St. Andrew's, N.B.
Darby, Stephen, F.C.S., 140, Leadenhall-street
Darling, W. H., F.C.S., 126, Oxford-street, Manchester
Davies, Edward, F.C.S., Royal Institution, Liverpool
Davies, R. H., F.C.S., 6, Bradmore-park-terrace, Goldhawk-road, W.
Davis, George E., F.C.S., 87, Barton-arcade, Manchester
Davis, Henry Wilson, Laboratory, Somerset-house, W.C.
Day, James John, 18, London-street, Derby
Deacon, Henry Wade, Appleton-house, Widnes
De Chaumont, Francis S.B.F., Army Medical School, Netley
De la Rue, Warren, D.C.L., F.R.S., 73, Portland-place, W.
Dent, William Y., F.C.S., Royal Arsenal, Woolwich, S.E.
Dewar, James, F.R.S., Cambridge
Dittmar, W., Anderson's College, Glasgow
Divers, E., M.D., F.C.S., Yokohama, Japan
Dodd, T. H., F.C.S., Royal Arsenal, Woolwich, S.E.
Dougall, Samuel S., Glenpark-villa, Busby
Downar, George Frederick, Workington
Dreyfus, Charles, 7, Chapel-walks, Manchester
Duncan, James, F.C.S., 71, Cromwell-road, S.W.
Dupre, Auguste, Ph.D., F.R.S., Westminster Hospital, S.W.

Early, William, Trinity College, Dublin
Eltoft, Thomas, F.C.S., 55, Torriano-avenue, N.W.
Estcourt, Charles, F.C.S., St. James's-square, Manchester
Evershed, F., 8, Dalrymple-terrace, Glenarm-road, Clapton, E.

Fairley, Thomas, F.R.S.E., F.C.S., 16, East-parade, Leeds
Farries, Thomas, F.C.S., 16, Coleman-street, E.C.
Fenton, Henry J. H., Christ's College, Cambridge
Ferguson, John, M.A., F.C.S., University, Glasgow
Field, Frederick, F.R.S., F.C.S., Hither-green-lodge, Lewisham, S.E.
Fletcher, Alfred, 5, Edge-lane, Liverpool
Foord, George, F.C.S., Royal Mint, Melbourne
Foster, William, B.A., F.C.S., Middlesex Hospital, W.
Francis, Ernest E. H., F.C.S., Port of Spain, Trinidad
Frankland, E., D.C.L., F.R.S., Royal College of Chemistry, South Kensington Museum, S.W.
Friswell, R. J., F.C S., 10, Clapton-square, E.
Fuller, William James, F.C.S., Bristol

Gale, Samuel, F.C.S., 338, Oxford Street
Galloway, Robert, M.R.I.A., F.C.S., Royal College of Science, Stephen's-green, Dublin
Gardner, J , F.C.S., 11, St. Paul's-crescent, Camden-square
Garrick, Andrew R., St. Helen's, Lancashire
Gatehouse, J. Wright, 36, Broad-street, Bath
Gilbert, J. H., Ph.D., F.R.S., Harpenden, St. Alban's
Gilchrist, Percy C., F.C.S., Blaenavon, Monmouthshire
Gladstone, J. H., Ph.D., F.R.S., 17, Pembridge-square, Hyde-park, W.
Glover, G. T., F.C.S., 30, Donegall-place, Belfast
Gordon, Joseph Gordon, F.C.S., 20, King-street, S.W.
Gore, George, F.R.S., Islington-row, Edgbaston, Birmingham
Graham, A. McDonald, F.C.S., Wellfield-villa, Turnchapel, Plymouth
Graham, Charles, D.Sc., F.C.S., University College, W.C.
Greenaway, A. J., F.C.S., 147, Upper-street, Islington, N.
Greenway, Thomas, The Sheffield Smelting Company, Sheffield
Gregory, H. R., 7, Quality-court, Chancery-lane, W.C.
Greville, H. Leicester, F.C.S., Bentinck-house, Stroud-green-road
Griess, P., Ph.D., F.R.S., F.C.S., Burton-on-Trent.
Grosjean, B. J., F.C.S., J. B. Lawes' Chemical Works, Millwall, E.
Groves, Charles Edward, F.C.S., Somerset-house-terrace, W.C.
Gurney, H. S. Lewis, 11, Wilson-Patten-street, Warrington.

Hake, H. Wilson, Ph.D., F.C.S., Palsgrave-place, Temple, W.C.
Halse, William Edward, F.C.S., 21, Mincing-lane, E.C.
Hanbury, Cornelius, F.C.S., Plough-court, E.C.
Harkness, W., F.C.S., Laboratory, Somerset-house, W.C.
Hartley, W. Noel, F.R.S.E., F.C.S., King's College, W.C.
Hastings, H. Mitchell, F.C.S., 16, Vicarage-gardens, Kensington
Heaton, C. W., F.C.S., Charing-cross Hospital, W.C.
Hehner, Otto, F.C.S., 54, Holborn Viaduct
Helm, H. J., F.C.S., Laboratory, Somerset-house, W.C.
Henry, William Charles, M.D., F.R.S., Haffield, near Ledbury
Herman, Douglas, F.C.S., Cropper's-hill, St. Helen's, Lancashire
Hewitt, David B., Beech-house, Prestwich, Radcliffe, near Manchester
Hibbert, Walter, F.C.S., 2a, Chapel-street, Edgware-road, W.
Heddle, Matthew Forster, St. Andrew's, Scotland
Higgin, James, F.C.S., Woodhey, Kersal, Manchester
Hill, Alfred, M.D., F.C.S., Birmingham
Hills, Thomas Hyde, F.C.S., 378, Oxford-street, W.
Hodges, Frederick, Queen's College, Belfast.
Hodges, John Frederick, M.D., F.C.S., Queen's College, Belfast
Hodgkinson, W. R., Sheffield
Holmes, John, Laboratory, Somerset-house, W.C.
Hopwood, G. Manley, F.C.S., Mining Department, Melbonrne.
Howard, David, F.C.S., Stamford-hill, N., and Stratford, E.
Howard, Thomas, F.C.S., 52, Swinton-street, Gray's-inn-road, W.C.
Howard, William Dilworth, Stratford, E.
Hurter, Ferdinand, Ph.D., Widnes
Huntington, A. K., Abbeville-house, Arkwright-road, Hampstead
Huskisson, Henry Owen, F.C.S., 42, Highbury-park, N.
Huson, C. W., 5, York-buildings, Dale-street, Liverpool
Hutchings, W. Maynard, Liscard, near Birkenhead
Huxley, James Henry, Crescent-road, Sharrow, Sheffield

Jackson, Edgar, 106, Queen Victoria-street, E.C.
Jarmain, George, F.C.S., 84, Northgate, Huddersfield
Johnson, George Stillingfleet, F.C.S., 11, Savile-row, W.
Johnson, Thomas H., F.C.S., 96, Duke-street, Liverpool
Jones, E. W. T., F.C.S., Wolverhampton
Jones, Francis, F.R.S.E., F.C.S., Grammar School, Manchester

Keates, Thomas William, 10, Spring-gardens, S.W.
Keane, James Boddely, 38, Hartham-road, N.
Keightley, Alfred Dudley, F.C.S., Old-hall, Milntborpe
Kellner, William, Ph.D., F.C.S., Royal Arsenal, Woolwich, S.E.
Kendall, James Alfred, F.C.S., Silvertown, E.
Kinch, Edward, F.C.S., Tokio, Japan
King, John Falconer, F.C.S., Edinburgh
Kingzett, C.T., F.C.S., 12, Auriol-road, West Kensington
Kitchin, Archibald, F.C.S., 27, King-street, Whitehaven
Kynaston, Josiah W., F.C.S., St. Helen's

Lawes, J.B., F.R.S., Rothamstead, St. Alban's
Lawson, George, LL.D., Dalhousie College, Halifax, Nova Scotia, Canada
Leehody, J. R., M.A., Magee College, Londonderry
Letts, Edmund Albert, University College, Bristol
Lewin, George, Laboratory, Somerset-house, W.C.
Liveing, George Downing, M.A., F.C.S., Cambridge
Liversedge, A., University, Sydney
Lott, Frank Edward, Burton-on-Trent
Loram, H. Y., F.C.S., 21, Median-road, Clapton, E.
Lowe, A. J. G., St. Helen's, Holmsdale-road, South Norwood
Lowe, W. Foulkes, F.C.S., Hough-green, Chester
Lupton, Sidney, F.C.S., The Harehills, Leeds
Lyte, F. Maxwell, F.C.S., Scientific Club, 7, Savile-row
Lyon, John George, Pontefract

Macadam, Stevenson, Ph.D., F.R.S.E., F.C.S., Edinburgh
Mactear, James, F.C.S., St. Rollox, Glasgow
Makins, George Hogarth, F.C.S., Walton-on-Thames
Manning, F.A., F.C.S., 18, Billiter-street, E.C.
Marcet, William, M.D., F.R.S., Athenæum Club, London
Marreco, A.F., F.C.S., College of Physical Science, Newcastle-on-Tyne
Maskelyne, Nevil Story, F.R.S., F.C.S., 112, Gloucester-terrace, W.
Matthey, George, F.C.S., 78, Hatton-garden, E.C.
McLeod, Herbert, F.C.S., Cooper's-hill, Staines
Meldola, Raphael, F.C.S., 21, St. John-street, Bedford-row
Miller, F. B., F.C.S., Royal Mint, Melbourne
Mills, E. J., D.Sc., F.R.S., Anderson's College, Glasgow
Mond, Ludwig, F.C.S., Winnington-hall, Northwich
Morfit, Campbell, Ph.D., F.C.S., 16, Harley-road, South Hampstead, N.W.
Morgan, Thomas M., Victoria College, Jersey
Moss, John, F.C.S., 300, High Holbern, W.C.
Morrison, Robert Milner, D.Sc., 13, Douglas-crescent, Edinburgh
Mucklow, J. Davies, F.C.S., 34, Penn-road, N.
Müller, Hugo, Ph.D., F.R.S., 110, Bunhill-row
Muspratt, Edmund K., F.C.S., Seafortb-hall, near Liverpool

Napier, James, F.C.S., Gipping-cottage, Bramford, near Ipswich
Nelson, Edmund, F.C.S., Scientific Club, Savile-row, W.
Newlands, John A. R., F.C.S., 13, Knowle-road, Brixton, S.W.
Newlands, B. E. R., F.C.S., Clyde-wharf, Victoria-dock, E.
Newth, G. S., New College, Hampstead
Nicholson, E. Chambers, F.R.S., Carlton-house, Herne-hill
Nicholson, Edward, M.D., F.C.S., St. Thomas-mount, Madras
Nickels, Benjamin, F.C.S., Sudbury, Harrow

Odling, W., M.B., F.R.S., 15, Norham-gardens, Oxford
Odling, Walter, F.C.S., Burton-on-Trent
Ogilvie, T. Robertson, F.C.S., Bank-top, Lyle-street, Greenock
Ogston, George Henry, F.C.S., 9, Delahay-street, London
Oilerenshaw, S., F.C.S., Sutton Alkali Werks, St. Helen's
O'Neill, Charles, F.C.S., 254, Oxford-street, Manchester
O'Sullivan, C., F.C.S., 140, High-street, Burton-on-Trent

Packer, George Smithers, F.C.S., Cambuslang, Glasgow
Page, David, M.D., F.C.S., Kendal
Page, F. J. Montague, F.C.S., University College, W.C.
Parker, John Spear, 13, New Porter-street, Sheffield
Parkinson, Robert, Ph.D., Bradford
Patterson, Thomas Law, F.C.S., Belmont, Margaret-street, Greenock
Pattinson, John, F.C.S., 75, The Side, Newcastle-on-Tyne
Pedlar, Alexander, F.C.S., Presidency College, Calcutta
Perkin, W. H., F.R.S., The Chestnuts, Sudbury, near Harrow
Phillips, John Arthur, C.E., F.C.S., 18, Fopstone-road, Kensington
Plowman, Sydney, F.C.S., Residences, St. Thomas' Hospital
Pochin, Henry Davis, F.C.S., Barn Elms, Barnes, S.W.
Prevost, Edward, Ph.D., F.C.S., Oxford
Price, Astley, Ph.D., F.C.S., 47, Lincoln's-inn-fields
Price, David S., Ph.D., F.C.S., 26, Great George-street, W.
Proctor, W. W., 33 and 35, Side, Newcastle-on-Tyne
Purdie, Thomas, jun., F.C.S.,, 31, Westbourne-park-crescent, W.

Ramsey, W., Ph.D., F.C.S., 11, Ashton-terrace, Glasgow
Reddrop, Joseph, F.C.S., London and North-Western Railway, Crewe
Redwood, Theophilus, Ph.D., F.C.S., 17, Bloomsbury-square, W.C.
Redwood, T. Boverton, F.C.S., Fairlawn, North Finchley, Middlesex.
Reid, Walter Cecil, Newcastle-on-Tyne
Reynolds, J. Emerson, M.D., F.C.S., Trinity College, Dublin
Reynolds, W. J., F.C.S., Royal Military Asylum, Chelsea, S.W.
Rich, Sidney William, 23, Lloyd-square, W.C.
Richards, Edward, Barrow-in-Furness
Riley, Edward, F.C.S., 14A, Finsbury-square, E.C.
Rimmington, George, 9, Bridge-street, Bradford
Roberts, T., 4, Alfred-road, Handsworth, near Birmingham
Robinson, John, Downside, Stoke Bishop, Bristol
Robinson, John Carr, F.R.S.E., Laboratory University, Edinburgh
Robson, T. S., 57, Side, Newcastle-on-Tyne
Rocholl, Heinrich, Middlesbro'-on-Tees
Rodwell, G. F., F.C.S., Marlborough College
Ronalds, E., Ph.D., F.R.S.E., Bonnington-house, Edinburgh
Roscoe, Henry E., Ph.D., F.R.S., F.C.S., Owen's College, Manchester
Rosenthal, Gustav, Ph.D., 31, Oakley-street, S.W.
Russell, W. J., Ph.D., F.R.S., St. Bartbolomew's Hospital, E.C.
Ryan, Dennis, The School of Medicine, Liverpool

Salter, Mortyn John, F.C.S., 112, Forest-road, Dalston
Schunck, Edward, Ph.D., F.R.S., Kersall, near Manchester
Sell, William James, B.A., 12, Downing-terrace, Cambridge
Senier, Alfred, M.D., F.C.S., 12, Brownswood-villas, Finsbury-park, N.
Shenstone, W. Ashwell, F.C.S., Exeter School, Exeter
Shepherd, H. H. B., F.C.S., The Leighs, Charlton-lane, S.E.
Siebold, Louis, F.C.S., Oxford-street, Manchester
Siemens, C. W., D.C.L., F.R.S., 3, Palace-houses, Kensington-gardens
Smee, Alfred Hutchinson, F.C.S., 7, Finsbury-circus, E.C.
Smith, Arthur Percy, F.C.S., Rugby.
Smith, J. Denham, F.C.S., 26, Onslow-gardens, S.W.
Smith, Robert Angus, Ph.D., F.R.S., 22, Devonshire-street, Manchester
Smith, Watson, F.C.S., Wilmslow, near Manchester
Snelus, George James, F.C.S., Workington
Sonstadt, Edward, F.C.S., 75, Churchill-road, N.W.
Spiller, John, F.C.S., 2, St. Mary's-road, Canonbury, N.
Spiller, William, F.C.S., Atlas Works, Hackney-wick
Stead, John Edward, Middlesborough
Stenhouse, John, LL.D., F.R.S., 17, Rodney-street, Pentonville, N.
Stevenson, James Cochran, M.P., F.C.S., Westow, South Shields
Stevenson, Thomas, M.D., F.C.S., Sandhurst-lodge, Gresham-road, Brixton, S.W.
Stewart, A. Young, F.C.S., Apothecaries'-hall, E.C.
Stewart, William Auld, F.C.S., Apothecaries'-hall, E.C.
Stock, William Frederick Keating, F.C.S., Darlington
Stoddart, William Walter, F.C.S., 1, Park-street, Bristol.
Stoker, G. Naylor, Laboratory, Somerset-house, W.C.
Sutton, Francis, F.C.S., Norwich
Swan, Joseph Wilson, F.C.S., Newcastle-on-Tyne
Szczepanowski, Stanislas A. Prus, F.C.S., 6, Stafford-place, Buckingham-gate, S.W.

Tate, Alexander Norman, 7 and 9, Hackin's-Hey, Liverpool
Tate, Walter, Bridgewater Smelting Company, St. Helen's
Tatlock, Robert R., F.C.S., 138, Bath-street, Glasgow
Taylor, R. L., F.C.S., 45, Glendale, Lower Broughton, Manchester
Thomas, Joseph William, F.C.S., Pen-y-lan, Cardiff
Thomson, J. Millar, F.C.S., King's College, W.C.
Thomson, William, F.C.S., Royal Institution, Manchester
Thorp, William, B.Sc., F.C.S., 39, Sandringham-road, N.E.
Tichborne, C. R. C., M.R.I.A., F.C.S., 40, Mary-street, Dublin
Tidy, Charles Meymott, M.B., F.C.S., 48, Queen Anne-street, W.
Tilden, W. A., D.Sc., F.C.S., Clifton College, Bristol
Tookey, Charles, F.C.S., The Museum, Jermyn-street
Tomlinson, Charles, F.R.S., 3, Ridgmount-terrace, Highgate, N.
Tribe, Alfred, F.C.S., Dulwich College
Tuson, Richard V., F.C.S., Royal Veterinary College, N.W.
Tyrer, Thomas, F.C.S., Garden Wharf, Battersea

Umney, Charles, F.C.S., 50, Southwark-street

Vacher, Arthur, F.C.S., 12, Fitzroy-street
Versmann, Frederick, Ph.D., 15, Trinity-square, E.C.
Vincent, C. W., F.R.S.E., F.C.S., Royal Institution, Albemarle-street, W.
Voelcker, A., Ph.D., F.R.S., 39, Argyle-road, Kensington, W.

Walenn, William Henry, F.C.S., 74, Brecknock-road, N.
Wallace, W., Ph.D., F.R.S.E., 138, Bath-street, Glasgow
Ward, G., F.C.S., Buckingham-terrace, Headingly, Leeds
Warington, Robert, F.C.S., Harpenden, Herts
Watt, Alexander, F.C.S., 24, Tbackery-street, Liverpool
Watson, David, D.Sc., F.C.S., Broughton Copper Works, Manchester
Watts, John, D.Sc., F.C.S., University Laboratory, Oxford
Way, John Thomas, F.C.S., 9, Russell-road, Kensington, W.
Welton, Walter, F.C.S., Rede-hall, Burston. Surrey
Whewell, G., F.C.S. Exchange-chambers, Blackburn
Whiffen, William George, Lombard-road, Battersea
Williams, John, F.C.S., 16, Cross-street, Hatton-garden, E.C.
Williams, M.W., F.C.S., 18, Kempsford-gardens, Brompton, S.W.
Williamson R., F.C.S., 1, Oxford-villas, Sudbury, Harrow
Williams, W. J., Olga-villa, Salcott-road, New Wandsworth
Wills, Thomas, Royal Naval College, Greenwich
Wilson, George Ferguson, F.R.S., Heather-bank, Weybridge
Wilson, James Henry, Oak-hall, East Ham, Essex
Wilson, William, F.C.S., Jubilee-street, Mile-end
Winser, Percy James, F.C.S., Marsden-street, Manchester
Witton, James Cecil, B.Sc., 29, Queen-street, Lancaster
Wood, Charles Henry, F.C.S., Calcutta
Woodcock, R. C., F.C.S., Agricultural College, Cirencester
Wright, C. R., Alder, D.Sc., F.C.S., St. Mary's Hospital, W.

Young, James, F.R.S., Kelly, near Greenock
Young, William Charles, F.C.S., Plaistow, Essex

ASSOCIATES.

Adair, A., Whitehaven

Bascombe, Frederick, 180, New Bond-street, W.
Bayne, James, F.C.S., Royal Veterinary College, N.
Beckett, G. H., F.C.S., 42, Malvern-road, Dalston, N.E.
Bendix, D., F.C.S., Prince Regent's Wharf, Victoria Docks, S.E.
Billing, H. S., 268, Vauxhall-bridge-road, S.W.

Carpenter, H. Sanders, F.C.S., The Firs, Alton, Hants
Clark, W. Inglis, D.Sc., Messrs. Duncan, Flockhart and Co., Edinburgh
Copley, James, Gregory-street, Nottingham
Cowper, R., F.C.S., 3, The Residences, South Kensington Museum

Davidson, James, Jun., Summerville, near Dumfries

Gahan, William Patrick, 56, Walton-street, S.W.
Gaskell, F., Newnham-lodge, Spring-grove, Isleworth
Gill, Edward J. G., 59, King Henry's-road, N.W.
Gibson, J., Ph.D., F.R.S.E., 29, Greenhill-gardens, Edinburgh
Greenish, H. G., 20, New-street, Dorset-square, N.W.

Haddock, Arthur, Royal Institution, Liverpool
Hannay, J. Ballantyne, F.C.S., Owens College, Manchester
Harland, W. Dugdale, 35, Acombe-street, Manchester
Hellon, Robert, 54, Rue d'Assas, Paris
Hollis, P. B., Mersey Chemical Works Widnes
Hughes, Hugh, 81, Troughton-street, Edgehill, Liverpool
Hutchinson, T. J., 91, Wood-street, Elton, near Bury

Jobson, Thomas, Jun., Newcastle-on-Tyne
Johnstone, W., 1, Finsbury-circus, E.C.
Jude, K. H., Christ's College, Cambridge

Lapraik, William, F.C.S., 211, Southgate-road, N.

Luff, A. Pearson, St, Mary's Hospital, Paddington, W.

Macadam, W. Ivison, Surgeons'-hall, Edinburgh
McGowan, George A., 24, Argyle-place, Edinburgh
Matthews, C. G., F.C.S., St. John's-lodge, Beckenham
Miller, John, Sheffield Smelting Company, Sheffield
MacIvor, R. W. E., 29, Queen-street, Melbourne

Neison, Cuthbert Gordon, Royal Veterinary College, N.W.

Paterson, George, 93, Canning-street, Liverpool
Patterson, George, 23, Arundel-square, N.
Pearson, A. Naylor, 7. Warwick-gardens, Kensington, W.
Powell, L. Sylvester, F.C.S., 56, St. James'-square, W.

Sear, Frederick, 17, Rodney-street, Pentonville, N.
Senier, Harold, F.C.S., 12, Brownswood-villa, Finsbury-park, N.
Smetham, Alfred, F.C.S., 1, Park-lane, Stoke Newingtun
Smith, Henry Russell, 1, Aubert-park, Highbury-park, N.
Starling, John, H., F.C.S., The Avenue, Erith

Thorne, Leonard Temple, 20, Elephantengasse, Wurzburg
Toms, F. Woodland, F.C.S., 7, Busby-place, Camden-road, N.W.

Walker, Henry Herbert, 344, Glossop-road, Sheffield.

Fellows and Associates are requested to give notice of change of address, &c., to the Secretary.

INSTITUTE OF CHEMISTRY OF GREAT BRITAIN and IRELAND.—The President offers TWO PRIZES of £50 each, to be awarded by the Council of the Institute, and announced at the next General Annual Meeting (Feb. 1st, 1879), for the two best Original Investigations involving Gas Analysis, and conducted by persons who must be Associates of the Institute at the time the award is made. For further information apply to the Secretary, Somerset-house-terrace, W.C.

Just published (London: J. and A. CHURCHILL). price 16s.

A HANDBOOK OF MODERN CHEMISTRY. By Charles Meymott Tidy, M.B., F.C.S., Professor of Chemistry and of Forensic Medicine at the London Hospital.

Just completed, a few copies of

FARADAY'S EXPERIMENTAL RESEARCHES IN ELECTRICITY (1839-55), 3 vols., 8vo. with 16 plates, cloth, £2 8s.

Each volume sold separately for 21s.

This book is still the great text-book of Electricians, and will always remain the Master Key of the science. New discoveries may and will be made, but to Faraday's Researches the scientific world will always have to refer as to their *Magnum Opus*.

Copies have lately sold for seven and eight guineas: the above should therefore be secured at once before the price rises again.

BERNARD QUARITCH, 15, Piccadilly, London.

THE
QUARTERLY JOURNAL OF SCIENCE.

Edited by WILLIAM CROOKES, F.R.S., &c

Now ready No. LVIII., *April*, 1878, price 5s.

CONTENTS.

I. Economy of Nitrogen.
II. On the Movements of Microscopic Particles Suspended in Liquids. By Prof. W. Stanley Jevons, LL.D., M.A., F.R.S.
III. Energy and Feeling: Alternate and Mutually Convertible Affections of Matter. By W. S. Duncan.
IV. The Gold and Placer Mines of Wicklow. By G. H. Kinahan, M.R.I.A., &c.
V. On the Relation of Moisture in Air to Health and Comfort. By Robt. Briggs, C.E.
VI. On Space of Four Dimensions, Illustrating the Phenomena ascribed to Spiritualism. By Prof J. C. Friedrich Zöllner, Leipzic. (With Page Lithograph.)
VII. Liquefaction of Oxygen. By M. Raoul Pictet. (Illustrated.)
VIII. The Phonograph. (Illustrated.)

Notices of Scientific Works, Scientific Notes, &c.

London: 3, Horse-Shoe Court, Ludgate Hill, E.C.

BERNERS COLLEGE of CHEMISTRY, in conjunction with the SCIENTIFIC DEPARTMENT of the ROYAL POLYTECHNIC INSTITUTION.

Instruction and preparation in CHEMISTRY and the EXPERIMENTAL SCIENCES under the direction of Professor E. V. GARDNER, F.A.S., M.S.A.

The Class Rooms are open from 11 to 5 a.m. and from 7 to 10 p.m daily.

Especial facilities or persons preparing for Government and other examinations.

Private Pupils will find every convenience.

Analyses, Assays, and Practical Investigations connected with Patents, &c., conducted.

Prospectuses and full particulars on application to Prof. Gardner at Berner's College, 44, Berners-street, W., or at the Royal Polytechnic Institution.

MANCHESTER CORPORATION GAS-WORKS.

AMMONIACAL LIQUOR.

The Gas Committee of the Corporation of Manchester are prepared to RECEIVE TENDERS for the PURCHASE of the AMMONIACAL LIQUOR to be produced at their Gaythorn and Rochdale Road Works during a period of one or more years, commencing from the 1st day of January, 1880. In addition to tenders for the purchase of the liquor in its crude state, the Committee will also be prepared to consider tenders for its disposal, either by manufacture into sulphate of ammonia at the above-mentioned works on their behalf, or in any other manner. The Committee reserve to themselves the option of accepting the offer the terms of which they deem most advantageous. They do not bind themselves to accept the highest or any tender. Sealed tenders, addressed to the Chairman of the Gas Committee, Town Hall, and endorsed "Tender for Ammoniacal Liquor," must be delivered at these offices on or before Thursday, the 1st day of August next.—Forms of tender and further particulars can be obtained on application to Mr. George B. Jackson, at the Gas Offices.—By order of the Gas Committee,

JOSEPH HERON, Town Clerk.

Town Hall, Manchester, 31st May, 1878.

Water-glass, or Soluble Silicates of Soda and Potash, in large or small quantities, and either solid or in solution, at ROBERT RUMNEY'S, Ardwick Chemical Works Manchester

THE CHEMICAL NEWS.

VOL. XXXVII. No. 969.

THE RELAYING OF THE TELEPHONE.

By Profs. EDWIN J. HOUSTON and ELIHU THOMSON of Philadelphia.

UPON the first announcement of the invention of the Bell articulating telephone the authors have been busily engaged endeavouring to relay the telephone, or to cause it to act as a repeater for an independent circuit. The exceedingly minute movements of the diaphragm of the receiving telephone, however, rendered all our efforts unsuccessful in practice, until the news reached us of the discovery by Prof. Hughes of the delicate microphone. The inexpressible sensitiveness of this instrument to feeble sound waves enables it to respond to even the feeble movements of the diaphragm of the receiving telephone, and by its means we have been successful in relaying this instrument.

The means by which we have at last accomplished this result are briefly as follows:—A minute microphone, consisting essentially of three pieces of carbon, is attached directly to the plate of the receiving telephone. The carbon pieces are arranged as described by Prof. Hughes, viz., two horizontal pieces with cavities on the sides facing each other, and the third piece, furnished with sharp ends, inserted in these cavities.

The microphone thus arranged is placed in the circuit on which the telephonic message is to be repeated. Those acquained with the marvellous delicacy of the microphone will not be surprised to learn that it transmits the movements imparted to it from the diaphragm of the telephone as variations in the intensity of the electrical current traversing the microphone circuit, and therefore acts as a relay or repeater.

In a number of experiments tried on various telephone circuits, one telephone relay or repeater was found to act admirably, although no especial attempt was made to properly proportion resistances. A number of microphones being used instead of one, with the battery circuits properly connected the effects would undoubtedly be increased.

Central High School, Phila.,
June 6, 1878.

ON RELATIONS AMONG THE ATOMIC WEIGHTS OF THE ELEMENTS.

By JOHN A. R. NEWLANDS, F.I.C., F.C.S.

BESIDES the relations among the atomic weights of the elements when arranged in their natural order which are now comparatively well known in connection with the periodic law, there are others of considerable interest, some of which will be briefly alluded to in the present communication,

In Table I. four separate scales of atomic weights are given, the first row of figures being the atomic weights, taking hydrogen = 1; the second row, taking sodium = 10; the third, taking chlorine = 15, nearly; and the fourth, taking carbon = 5.

Starting with the ordinary atomic weights the sum total of those of the known elements is 6227·9, and this sum, divided by the number of elements in the Table, viz., 64, gives an average atomic weight of 97·31 for each element, when hydrogen is taken as unity.

TABLE I.

Symbol.	At. Wt.	At. Wt. ÷2·3 or Na=10.	At. Wt. ÷2·37 or Cl=15 nearly.	At. Wt. ÷2·4 or C=5.
H ..	1·0	0·435	0·422	0·417
Li ..	7·0	3·04	2·95	2·92
Be ..	9·4	4·09	3·97	3·92
B ..	11·0	4·80	4·64	4·58
C ..	12·0	5·22	5·06	5·00
N ..	14·0	6·09	5·91	5·83
O ..	16·0	6·96	6·75	6·67
F ..	19·0	8·26	8·02	7·92
Na ..	23·0	10·00	9·70	9·58
Mg ..	24·0	10·43	10·13	10·00
Al ..	27·4	11·91	11·56	11·42
Si ..	28·0	12·20	11·81	11·67
P ..	31·0	13·48	13·08	12·92
S ..	32·0	13·91	13·50	13·33
Cl ..	35·5	15·43	14·98	14·79
K ..	39·1	17·00	16·50	16·29
Ca ..	40·0	17·39	16·88	16·67
Ti ..	50·0	21·74	21·09	20·83
V ..	51·2	22·26	21·60	21·33
Cr ..	52·2	22·70	22·03	21·75
Mn ..	55·0	23·91	23·21	22·92
Fe ..	56·0	24·35	23·63	23·33
Ni ..	58·8	25·57	24·81	24·50
Co ..	58·8	25·57	24·81	24·50
Cu ..	63·4	27·57	26·75	26·42
Zn ..	65·2	28·35	27·51	27·17
Ga ..	69·9	30·39	29·49	29·12
As ..	75·0	32·61	31·65	31·25
Se ..	79·4	34·52	33·50	33·08
Br ..	80·0	34·78	33·76	33·33
Rb ..	85·4	37·13	36·03	35·58
Sr ..	87·6	38·09	36·96	36·50
Y ..	88·0?	38·26	37·13	36·67
Zr ..	89·6	38·96	37·81	37·33
Nb ..	94·0	40·87	39·66	39·17
Mo ..	96·0	41·74	40·51	40·00
Rh ..	104·4	45·39	44·05	43·50
Ru ..	104·4	45·39	44·05	43·50
Pd ..	106·6	46·35	44·98	44·42
Ag ..	108·0	46·96	45·57	45·00
Cd ..	112·0	48·70	47·26	46·67
In ..	113·4	49·30	47·85	47·25
Sn ..	118·0	51·30	49·79	49·17
Sb ..	122·0	53·04	51·48	50·83
I ..	127·0	55·22	53·59	52·92
Te ..	128·0	55·65	54·01	53·33
Cs ..	133·0	57·83	56·12	55·42
Ba ..	137·0	59·57	57·81	57·08
Di ..	138·0?	60·00	58·23	57·50
Ce ..	140·0?	60·87	59·07	58·33
Er ..	178·0?	77·39	75·11	74·17
La ..	180·0?	78·26	75·95	75·00
Ta ..	182·0	79·13	76·79	75·83
W ..	184·0	80·00	77·64	76·67
Au ..	197·0	85·65	83·12	82·08
Pt ..	197·4	85·83	83·29	82·25
Ir ..	198·0	86·09	83·54	82·50
Os ..	199·2	86·61	84·05	83·00
Hg ..	200·0	86·96	84·39	83·33
Tl ..	203·6	88·52	85·91	84·83
Pb ..	207·0	90·00	87·34	86·25
Bi ..	210·0	91·30	88·61	87·50
Th ..	235·0	102·17	99·16	97·92
U ..	240·0	104·35	101·27	100·00

The atomic weights at present known do not correspond to the natural order, but appear to be a multiple of the latter; so that any calculation which may be made with a multiple of the ordinal numbers may also be made, though somewhat roughly, with the atomic weights.

In Table II. the elements are arranged in sevens, the

TABLE II.

HORIZONTAL ARRANGEMENT IN SEVENS. AT. WT. ÷ 2·3, OR Na = 10·00.

No.		No.		No.		No.		No.		No.		No.	
		2. Li	3·04	9. Na	10·00	16. K	17·00	23. —	—	30. Cu	27·57	37. Rb	37·13	44. —	—
		3. Be	4·09	10. Mg	10·43	17. Ca	17·39	24. —	—	31. Zn	28·35	38. Sr	38·09	45. —	—
		4. B	4·80	11. Al	11·91	18. —	—	25. Fe	24·35	32. Ga	30·39	39. Y	38·26	46. —	—
		5. C	5·22	12. Si	12·20	19. Ti	21·74	26. —	—	33. —	—	40. Zr	38·96	47. Rh	45·39
		6. N	6·09	13. P	13·48	20. V	22·26	27. —	—	34. As	32·61	41. Nb	40·87	48. Ru	45·39
		7. O	6·96	14. S	13·91	21. Cr	22·70	28. Ni	25·57	35. Se	34·52	42. Mo	41·74	49. Pd	46·35
1. H	0·435	8. F	8·26	15. Cl	15·43	22. Mn	23·91	29. Co	25·57	36. Br	34·78	43. —	—	50. —	—

TABLE III.

HORIZONTAL ARRANGEMENT IN SEVENS AND TENS. AT. WTS. ÷ 2·37, OR Cl = 15 NEARLY.

No.		No.		No.		No.		No.		No.	
		2. Li	2·95	9. Na	9·70	16. K	16·50	26. Cu	26·75	36. Rb	36·03
		3. Be	3·97	10. Mg	10·13	17. Ca	16·88	27. Zn	27·51	37. Sr	36·96
		4. B	4·64	11. Al	11·56	18. —	—	28. Ga	29·49	38. Y	37·13
		5. C	5·06	12. Si	11·81	19. Ti	21·09	29. —	—	39. Zr	37·81
		6. N	5·91	13. P	13·08	20. V	21·60	30. As	31·65	40. Nb	39·66
		7. O	6·75	14. S	13·50	21. Cr	22·03	31. Se	33·50	41. Mo	40·51
1. H	0·422	8. F	8·02	15. Cl	14·98	22. Mn	23·21	32. Br	33·76	42. —	—
						23. Fe	23·63	33. —	—	43. Rh	44·05
						24. Ni	24·81	34. —	—	44. Ru	44·05
						25. Co	24·81	35. —	—	45. Pd	44·98

atomic weight of sodium being taken as 10. The atomic weights given in this Table approach pretty closely to the ordinal numbers, and if the ordinal numbers are considered as forming a straight line, the atomic weights will form a curved line, crossing and re-crossing the straight line at certain intervals, but not deviating widely therefrom. The average atomic weight in this Table is 42·31, and the average ordinal number 42·36.

All our views upon the subject of the ordinal numbers to be attached to various elements are liable to be corrected by the light of future experience. There may be elements having atomic weights as much above uranium as uranium is above hydrogen, and, on the other hand, there may be elements having atomic weights as much below hydrogen as hydrogen is below uranium. In the latter case, such an element would almost escape detection by gravimetric analysis, though it might considerably influence the character of the compounds into which it entered. But though there is no fixed limit to either the maximum or minimum atomic weight which may belong to unknown elements, such as those above alluded to, it is interesting to observe how, by simply dividing the ordinary scale of atomic weights of known elements by one and the same number, we obtain figures almost identical with the ordinal numbers.

This agreement is perhaps more evident in Table III., where the elements are arranged in sevens and tens, the atomic weights being divided by 2·37, or that of chlorine being taken as 15, nearly.

Further remarks on this subject are reserved for a future paper.

Laboratory, 9, Mincing Lane, E.C.,
May 25, 1878.

ON THE ESTIMATION OF TANNINS.*

By H. R. PROCTER.

IN view of the great diversity of results yielded by different methods of tannin estimation, and the importance for trade purposes of the adoption of some uniform standard, Kathreiner has recently published the results of a critical examination of the more important processes at present in use, with a view to selecting such as combined accuracy and constancy with sufficient simplicity for practical employment.

* Abstract of a Paper by F. Kathreiner, *Dingler's Polyt. Journ.*, No. 227, p. 481.

At the outset he notes the importance of absolute attention to details in such analyses, and instances Fehling's method of sugar estimation as one in which dependable results are only obtainable when *all* precautions are fully carried out.

He also points out a fact which is too often overlooked by analysts, viz., that there are many different tannins, and that no real percentage can be calculated till the actual tannin itself has been isolated and its coefficient determined, which, so far, has been done in but very few cases. Even if the actual percentage of the unknown tannin in some new material could be calculated, it would not necessarily settle its commercial value, which depends on the character as well as on the mere quantity of tannin, and on the presence of other matters which affect the quality of the leather, so that results of analyses can only enable us to compare the relative worth of different samples of the same material, bark with bark, sumach with sumach. For this purpose no absolute statement of percentage is needed, but if it must be given the basis of the calculation must be carefully stated.

The methods which Kathreiner selected as seeming to comply with the preliminary requirement of simplicity were five, viz., those of Carpené (-Barbieri), Hammer, Clark, and Jean.

The method of Carpené as improved by Barbieri consists in adding to the tannic solution an excess of ammoniacal solution of zinc acetate, and evaporating the mixture by the aid of heat to two-thirds of its original volume. After cooling, the precipitate is filtered out, washed with hot water, and then dissolved in weak sulphuric acid, and titrated with permanganate and indigo. The method is described in Bolley's "Handbuch der technish-chemischen Untersuchungen" (1876, part 2, p. 782), and by it Barbieri seems to have obtained conconstant results. Kathreiner, however, made a very large number of determinations under different conditions, using various proportions of zinc solution, and evaporating more or less rapidly. He employed both infusions of sumach and solutions of so-called *pure* tannin. He found the results wholly unreliable, the permanganate consumed varying in one set of experiments from 3·15 to 0·7 c.c. for 10 c.c. of tannin solution, according to the excess of zinc solution, and in another equally widely with quicker or slower evaporation. The highest results were obtained, in each case respectively, by employment of the smallest excess of ammoniacal solution of zinc, and by the most rapid evaporation.

Löwenthal's original method, as is well known, consists

TABLE II. (continued.)

No.		No.		No.		No.		No.		No.		No.		No.		No.			
51. Ag	46·96	58. Cs	57·83	65. —	—	72. —	—	79. —	—	86. Au	85·65	93. —	—	100. —	—				
52. Cd	48·70	59. Ba	59·57	66. —	—	73. —	—	80. —	—	87. Hg	86·96	94. —	—	101. —	—				
53. In	49·30	60. Di	60·00	67. —	—	74. Er	77·39	81. —	—	88. Tl	88·52	95. —	—	102. —	—				
54. Sn	51·30	61. Ce	60·87	68. —	—	75. La	78·26	82. Pt	85·83	89. Pb	90·00	96. —	—	103. Th	102·17				
55. Sb	53·04	62. —	—	69. —	—	76. Ta	79·13	83. Ir	86·09	90. Bi	91·30	97. —	—	104. —	—				
56. Te	55·65	63. —	—	70. —	—	77. W	80·00	84. Os	86·61	91. —	—	98. —	—	105. U	104·35				
57. I	55·22	64. —	—	71. —	—	78. —	—	85. —	—	92. —	—	99. —	—	106. —	—				

TABLE III. (continued.)

No.		No.		No.		No.		No.		No.		No.		No.		No.			
46. Ag	45·57	56. Cs	56·12	66. —	—	76. —	—	86. Au	83·12	96. —	—								
47. Cd	47·26	57. Ba	57·81	67. —	—	77. —	—	87. Hg	84·39	97. —	—								
48. In	47·85	58. Di	58·23	68. —	—	78. Er	75·11	88. Tl	85·91	98. —	—								
49. Sn	49·79	59. Ce	59·07	69. —	—	79. La	75·95	89. Pb	87·34	99. Th	·16								
50. Sb	51·48	60. —	—	70. —	—	80. Ta	76·79	90. Bi	88·61	100. —	—								
51. Te	54·01	61. —	—	71. —	—	81. W	77·64	91. —	—	101. U	101·27								
52. I	53·59	62. —	—	72. —	—	82. —	—	92. —	—	102. —	—								
53. —	—	63. —	—	73. —	—	83. Pt	83·29	93. —	—	103. —	—								
54. —	—	64. —	—	74. —	—	84. Ir	83·54	94. —	—	104. —	—								
55. —	—	65. —	—	75. —	—	85. Os	84·05	95. —	—	105. —	—								

In titrating the tannin solution with permanganate in presence of indigo and a large volume of water, the quantity of permanganate required for the complete oxidation of the indigo being separately determined and deducted from the result. The indigo not only acts as an indicator, but as a regulator of the reaction, and should be present in such quantity as to require about twice as much permanganate for its oxidation as is consumed by the tannin employed in the titration. In this case the whole of the tannin is oxidised to secondary products before the complete destruction of the indigo, while the secondary products—being more stable than the indigo—are unattacked.

This process has the merit of being simple and rapid, and also constant in its results, but in its original form these results are always too high, from the presence of gallic acid and similar bodies, which are oxidised and reckoned as tannin. This difficulty may be overcome by a second titration after absorbing the tannin with hide raspings; but this is tedious, and not easy to accomplish completely. Löwenthal has recently proposed an improvement which seems completely to meet the difficulty (*Zeitschrift für Anal. Chem.*, 1877, pp. 33 and 201). This consists in the precipitation of the tannin by gelatin solution saturated with common salt and slightly acidified. Löwenthal prepares the gelatin solution by steeping 25 grms. of the finest Cologne glue in cold water overnight, which is then melted on the water-bath, saturated with NaCl, and made up to 1 litre with saturated NaCl solution, filtered, and kept well corked: 100 c.c. of this solution is mixed with 100 c.c. of the tannin infusion, and, after stirring, 50 c.c. of water, containing 2½ grms. of sulphuric or 5 grms. of hydrochloric acid, is added. This causes the precipitate to coagulate rapidly, and after standing some hours, or overnight, a perfectly clear filtrate is obtained, in which to titrate the oxidisable matters "not tannin." (In the experience of the writer it is advantageous to reduce the gelatin to one-half the above quantity, which is amply sufficient for all suitable strengths of tannin infusion, if the acid solution also is saturated with salt.) 50 c.c. of the filtrate, equivalent to 20 c.c. of the original infusion, is usually employed for determination of the "not tannin."

The standard permanganate solution employed by Kathreiner contained 1·333 grms. permanganate per litre, and 24·1 c.c. corresponded to 0·063 grm. oxalic acid, while 20 c.c. of the solution of sulph-indigotate of potash employed required 9·5 c.c. of permanganate for its oxidation. *The strength and quantity of the tannin infusion employed must be such that in no case it requires more than two-thirds as much permanganate solution for its oxidation as the indigo*, and it is better that the latter should not require more than about 10 c.c. of the permanganate, or the darkened colour of the oxidation-products interferes with the delicacy of the end-reaction. The general method employed by Kathreiner is to add 20 c.c. of indigo solution, 10 c.c. of dilute (1 to 5) sulphuric acid, and a suitable proportion of the tannin infusion, to about 1 litre of water, and titrate with permanganate in a white porcelain basin, *very slowly*, and with constant stirring. This Kathreiner considers decidedly preferable to the usual beaker and porcelain slab, the end of the reaction being indicated by a faint rose tint round the edge of the liquid. The time allowed in titration is of great importance: not less than four minutes should be occupied with the simple tannin solution, or six in the presence of gelatine, which impedes the reaction, as Dr. Lunge has shown that viscous substances usually do. If this precaution be neglected, results considerably too high are obtained.

Employing these precautions Kathreiner obtained always constant results, and found that, even for two or three successive days, tannin solutions gave results practically identical if protected by the addition of 0·5 c.c. glacial acetic acid. He found, as the writer had previously done, that the titrations could be carried out as well by artificial as by day light without any difference in the final result, though the quantity of permanganate employed by gas-light was slightly higher. He gives it as his opinion that if the light of a petroleum lamp with opal shade were employed the end-reaction would be identical; but as any variation, so long as it is constant, has no effect on the final result, the matter is of little moment.

A point of more importance is how far the result is affected by oxidation of the gelatin, or of some oxidisable body contained in it. Kathreiner found that 50 c.c. of his gelatin solution increased the consumption of permanganate by 1·5 c.c. beyond that needed for the indigo alone. Now the 50 c.c. of filtrate usually employed in estimating the "not tannin" contains 20 c.c. of the gelatin solution, equalling 0·6 c.c. of permanganate, but in all probability part at least of the oxidisable matter is carried down by the tannin; probably, therefore, the nearest approach to truth may be obtained by deducting *half* the correction for gelatin from the oxidisable matter not tannin.

As a basis of calculation Kathreiner agrees with the writer in preferring the numbers given by Neubauer and and Oser (viz., 0·063 grm. oxalic acid = 0·04157 gallo-

tannic or 0·062355 quercitannic acids) to any attempt at comparison with so-called "pure" tannin, which often contains 20 per cent of impurities.

Kathreiner quotes Gauhe, Hewett, and myself as agreeing with him in considering Löwenthal's a rapid and easy method of analysis, and well adapted for practical use. It may be added that the method is employed by Eitner for the numerous analyses of the Vienna Government Leather Research Laboratory, and he also adopts Neubauer's and Oser's numbers for calculation.

Kathreiner's results with Clark's and Jean's methods may be very briefly stated. The first consists in precipitation of the tannin by sulphate of cinchonine, and estimation of the cinchonine by solution of mercuric chloride in potassic iodide. The end-reaction proves extremely uncertain.

Jean's method, depending on the combination of iodine with tannin and gallic acid in presence of sodic carbonate, the termination of the reaction being decided by bringing drops of the solution in contact with starch paste, was found deficient in sharpness, and the most tedious of all, owing not only to the trouble of each separate titration, but to the fact that at least six titrations in each case were necessary, viz., one approximate and two final determinations of the original infusion, and a repetition of the same after the tannin was removed by gelatin and alcohol or hide raspings. The alcohol also may lead to error, by combining with the iodine to form iodoform.

Hammer's specific gravity process is condemned not only on account of the extreme accuracy required in the areometric determinations, but because it is quite uncertain if all tannins have the same specific gravity in solution. Another and yet more formidable objection, which applies equally to the original method and to its modification by Müntz and Ramspacher, is the fact—already pointed out by the present writer—that the results are completely vitiated, not only by the glutinous matter dissolved from the raw hide employed to remove the tannin, however carefully it may have been previously washed, but by the fact that raw hide has the property of removing, and temporarily holding in combination, considerable quantities of gallic or any other acid which may happen to be present.

On the strength of these experiments Kathreiner recommends Löwenthal's improved process, with the numerical values obtained by Neubauer and Oser, for general adoption as the standard method of tannin estimation—a proposal in which the present writer heartily concurs.

The only adverse criticism noted is that of Mohr, who, however, seems to confound the Löwenthal method with that of Monier, in which no indigo was used as regulator and indicator, and the objections he makes—valid enough with regard to this—are not applicable to the later and improved method.

ON DYERS' CHEMICALS.

By J. MARZELL.

(Continued from p. 190)

II. Naphthalin.

As we have seen, naphthalin is a body easy to be got in large quantities and in a state of great purity. The most varied researches have been made to use naphthalin as a base for artificial dyes, so as to replace the more valuable benzol, but till now only small success can be noted. Though splendid dyes of nearly all shades have been produced, up to the present the mischief of an expensive production, and their not being genuine was always the weak and insurmountable point, owing to which they had to give way to the competition of even less brilliant derivatives of other hydrocarbons.

Another way of experimenting—to open up a new field for its working up—was followed up in the direction of using it as a source of other hydrocarbons by the destructive decomposition of naphthalin, and attention was especially directed to three principal points:—

(1.) Formation of lighting-gas.
(2.) Formation of benzol and homologues.
(3.) Formation of anthracen.

They are all based upon the following speculation:—Naphthalen is a product of the reciprocal reaction of the same bodies.

(1.) Representing in themselves the principal parts of lighting-gas:—

$$\underbrace{C_2H_2}_{\text{Acetylen.}} \quad \text{and} \quad \underbrace{C_2H_4}_{\text{Ethylen.}}$$

(2.) Combining themselves to benzol—

$$\underbrace{3C_2H_2}_{\text{Acetylen.}} = \underbrace{C_6H_6}_{\text{Benzol.}}$$

(3.) Forming, with the same intermediate body as belonging to naphthalin—styrol—anthracen.*

$$\text{I. } (a)\ \underbrace{C_6H_6}_{\text{Benzol.}} + \underbrace{C_2H_4}_{\text{Ethylen.}} = \underbrace{C_8H_8}_{\text{Styrol.}} + 2H.$$

$$\underbrace{C_8H_8}_{\text{Styrol.}} + \underbrace{C_2H_4}_{\text{Ethylen.}} = \underbrace{C_{10}H_8}_{\text{Naphthalin.}} + 2H.$$

$$\text{I. } (b)\ \underbrace{C_8H_8}_{\text{Styrol.}} + \underbrace{C_6H_6}_{\text{Benzol.}}\dagger = \underbrace{C_{14}H_{10}}_{\text{Anthracen.}} + 4H.$$

$$(a)\ \underbrace{C_6H_6}_{\text{Benzol.}} + \underbrace{2C_2H_4}_{\text{Ethylen.}}\ddagger = \underbrace{C_{10}H_8}_{\text{Naphthalin.}} + 2H.$$

$$(b)\ \underbrace{2C_6H_6}_{\text{Benzol.}} + \underbrace{C_2H_4}_{\text{Ethylen.}} = \underbrace{C_{14}H_{10}}_{\text{Anthracen.}} + 6H.$$

To decompose naphthalin the same way was followed which led to its formation—dry distillation, effected by the leading of naphthalin vapours through red-hot iron pipes. The results, however, did not turn out satisfactory.

I. *Use for Lighting-Gas.*

Already, in 1867, John Hamilton took a patent in this direction. The proportions he is stating are 1 ton of powdered coal mixed with 480 k. creosote oils and 2½ k. naphthalin. The whole is submitted to distillation. The yield is said to be 420 c.m. of a very good gas. Following other statements it is 600 to 800 c.b. per 1 c.m. of the mixture.

Another idea was to dilute naphthalin in petroleum or crude coal-tar oils, let the fluid be sucked up by porous bodies (turf, wood, &c.), and submit the whole to a distillation in a retort.‖ About the results there is nothing published.

If the vapours of naphthalin, so rich in carbon, could be added to lighting-gas a higher illuminating power of the latter could be expected. But researches show naphthalin to have such a very small power of evaporation that no speculation could possibly be based upon it. At common temperature, exposed to the air, only 6½ per cent of the naphthalin evaporated away in nine days.

About the conversion into gas itself the results were no better. The apparatus used consists of an iron pipe, being filled with pieces of bricks to multiply the surface, being kept red-hot. The naphthalin vapours passed through slowly did not yield any permanent gases, the naphthalin condensing undecomposed in the receiver.

Exposing naphthalin vapours to heat, together with hydrogen gas, to effect assimilation, and gathering the gas

* Berthelot, "Chimie Fondée sur la Synthese," i., p. 34, 50.
† G. Auerbach, "On Anthracen;" London, 1877, p. 15.
‡ Berthelot, *Zeit. f. Analyt. Chemie*, 1869, 37.
‖ Martin, *Journ. f. Gasbeleuchtg.*, 1868, ix., p. 250.

escaping out of the condenser over water, did not give any results. After cooling, the gas was allowed to issue from a fine jet, but the blue flame proved that the hydrogen gas was not saturated with any hydrocarbons, as was expected.

In looking at the parallel researches with the heavy petroleum oils, it is strange that by this same method such good results could be obtained, utilised practically in the so-called Lowe's process,* which seems to answer all expectations. It consists in principle in mixing the vapours of very heavy paraffin oils with hydrogen—got by passing water over anthracite coal at a white heat,† The yield is said to be of the best quality, and combining with its other good points the advantage of being 35 per cent cheaper than the ordinary light-gas.

Other researches of Wagner, to pass the naphthalin vapours through red-hot pipes together with paraffin oils, did not turn out better results than the former experiments, and comparing this with Hamilton's patent we must come to the conclusion that in them coal plays a principal *rôle*.

Phillips, Besling, and Kohlstadt‡ have tried to use naphthalin for illuminating by burning it together with other hydrocarbons in oxygen. The patent prescribes a mixture of 40$C_{10}H_8$ and 60 mineral oils, and special lamps have been made for that purpose.

II. *Working Up for Benzol Homologues.*

Here also the researches did not end satisfactorily. On passing the naphthalin through heated pipes by itself and with steam did not give any results. Though with the intermediate phases "phthalic acid and benzoic acid" the formation of benzol does not offer many difficulties, that process, on account of its complication, will never have any practical interest unless the speculation was realised by a direct and cheap oxidation process (perhaps by having naphthalin vapours over heated peroxides of manganese, lead, barium, &c., to convert the naphthalin directly into benzoic acid, from which benzol could be got without great loss by distillation with lime.

J. Rowley|| follows up another way for the same purpose. He saturates naphthalin with chlorine gas, and then submits the resulting mixture of chlorine compounds and free naphthalin to distillation. At first oil passes over, and afterwards a fatty matter can be gathered. This mass is added, from 10 to 25 per cent, to a naphtha highly purified by H_2SO_4 beforehand. In distilling, benzol and its homologues are got, from which aniline dyes can be made. Instead of distillation, the fatty matter can be separated from the liquid part by pressing or filtering, but the first way is to be preferred. The results of this method are not published. In saturating with chlorine gas a mixture of chlorine derivatives of the naphthalin addition- and substitution-products and of unattacked naphthalin are formed. We shall return or refer to the former again when speaking of phthalic acid.

III. *Working Up for Anthracen.*

It is curious that the patent out on this subject by J. Barrow§ follows the same way, having shown no results whatever in the above-mentioned identical process—the decomposition by heat. According to the patent—"Naphthalin vapours, or hydrocarbons containing naphthalin, are passed through retorts heated sufficiently to decompose the naphthalin. The obtained anthracen is purified by distillation, crystallisation, and sublimation." As there are no results published about this, the importance of the matter induces me to make some researches of the same. The iron pipe was about 1½ inches, and was heated to a clear red-heat in a combustion-furnace (with the principal part of the experiments the furnace was heated with charcoal). The tube was either left empty or filled with charcoal, and—it may have been only an accident—in the latter case I observed that the decomposition proceeded easier. The naphthalin vapours were always passed through very slowly. The resulting product consisted mostly of undecomposed naphthalin, but a small quantity of fluid and a green sublimate could always be identified. To test the anthracen the product was pressed and dried, and then submitted to an oxidation with chromic acid and glacial acetic acid, the resulting anthraquinon being calculated back to anthracen. By the violent oxidation naphthalin was destroyed, being converted into phthalic acid, which was washed out with water. As I could not finish my researches definitely, I cannot give numbers as to the yield, but will only remark that the result was in most cases between 0·1 and 0·2 per cent of the naphthalin really passed through the tubes. I hope to be able to conclude the researches soon, and shall not fail to communicate the results as addition to the above.

Comparing the contradictory results of the different searchers, it is easy to see that a wide field is here still open both to practical speculation and theoretical work. A body got in such, we may say, unlimited quantities, and in such a state of purity by the most simple means of purifying, offers too many advantages as crude material for it to be thrown away as useless before the most exhausting researches have been made.

It has been recommended to use the naphthalin in agriculture against the attacks of insects. It does not kill them, only drives them away by its smell. Its small evaporating power, combined with a comparatively strong odour, makes it fit for this purpose.

(To be continued)

* L. Ramdohr, *Dingler's Journal*, ccxxii., p. 153.
† *Wagner's Jahresberichte*, 1875, p. 1118.
‡ A.D. 1869, No. 1911.
|| Patent 2222, A.D. 1869.
§ A.D. 1870, No. 1120.

NOTICES OF BOOKS.

Ure's Dictionary of Arts, Manufactures, and Mines. By Robert Hunt, F.R.S. Vol. iv., Supplement. London: Longmans and Co., 1878.

The last edition of Ure's Dictionary was published in 1875, and the appearance of a supplement, bringing our information down to the beginning of the present year, will be hailed with satisfaction both by the manufacturer and the technological student. The arts and manufactures are now-a-days making such perpetual progress that it is almost impossible to keep pace with them, even with so watchful and laborious an editor and staff as the Keeper of the Mining Records and his able assistants. A great deal may, however, be effected by the frequent publication of supplementary volumes instead of waiting until a new edition of the work is necessary. This has been done in the present case and in that of the sister work, "Watts's Dictionary of Chemistry," and we do not see why such supplements should not be issued even yearly, the whole being collected into a new edition at the end of every seven years.

While the present work was passing through the press an instance occurred which shows the conscientious way in which the editor has endeavoured to keep abreast of the times; but in spite of his most strenuous efforts, he was of necessity obliged to give in just at the end of the race. While the last sheets of the work were being corrected certain improvements were made in the phonograph and the electric light, and MM. Cailletet and Pictet announced their grand discoveries. These important items were too late to appear in their proper places; an account of them was therefore added as an addendum at the end of the book, but hardly had Mr. Hunt sat down to rest himself after his arduous task than the microphone and its wonders burst upon the world, too late, of course, to receive any notice at all.

On testing the work in numerous places we find that the information given is most complete, and is brought down to the latest possible date, as may be easily guessed

when we state that we have full details of the telephone, the phonograph, MM. Cailletet and Pictet's methods of solidifying and liquefying oxygen, hydrogen, and nitrogen, the Jablochkoff electric candle, and the latest improvements in electric illumination; the newest processes in the direct conversion of iron into steel by the Bessemer and Siemens's methods, the coal-tar dyes, and a large number of other discoveries, the present volume being the first manual of the kind in which they are described.

Taking a few headings almost at random we find under artillery an excellent account of the 81-ton gun; under diamonds we have a long and interesting description of the discoveries at the Cape of Good Hope. Artificial alizarin and its congeners, and the numerous compounds of a tinctorial nature lately obtained from anthracen and naphthalin, are well described. As might have been expected Mr. Hunt has taken particular pains with the articles connected with his own special subject, such as mining and metallurgy, the whole of which are of the greatest interest and value. The account given of the different forms of rock-boring machinery is most exhaustive, and is illustrated by nearly forty cuts and diagrams. The completeness of these articles, it must be understood, in no way interferes with the fulness of the information given on other subjects. Another excellent article on the industrial applications of the spectroscope very fully describes the experiments made by Professor Roscoe and Dr. Marshall Watts in connection with the Bessemer process, as well as those made by Sir J. G. W. Alleyne for the detection of small quantities of phosphorus in iron and steel. The tentative enquiry made by Messrs. Norman Lockyer and Chandler Roberts into the possibility of applying the spectroscope to the quantitative analysis of gold alloys is also well described. The article on explosives is particularly complete, a short account of Nobel's very latest invention—blasting gelatin—appearing amongst the addenda at the end of the book.

A large proportion of the articles are written by the discoverers and inventors themselves, either expressly for the work or for some English or foreign technological journal. This method of obtaining information no doubt insures its correctness, but inventors and discoverers are only mortal after all, and are sometimes open to the charge of concealing, or at any rate extenuating, the defects of their offspring. Some of the extracts would have borne condensation without much harm. Jocular and gossipping letters from the *Times* on the preservation of lime-juice, or the spontaneous fracture of a toughened glass gas globe in a lady's bedroom, are hardly fit for insertion in a serious work such as the present, without some kind of editorial excision or manipulation.

Mr. Hunt has been assisted in his labours by a goodly host of fellow workers, both British and foreign, who seem to have joined in the task with as much industry and good will as their veteran leader.

Mr. Hunt sets an excellent example to the editors and compilers of similar works who are only too fond of taking their information from every possible source without ever thinking of mentioning their indebtedness to the original author or periodical whose stores they have ransacked; Mr. Hunt, on the contrary, in nearly every instance, cheerfully acknowledges the source whence he obtains his knowledge. Another good point in the book is the frequency with which the editor gives us bibliographical references to original papers and researches, when, from considerations of space and interest, he has been obliged to shorten a description or omit details. The cross references are numerous and add much to the handiness of the book.

It would be folly to expect absolute perfection in a work of the kind, but the proof sheets in a few instances appear to have been read by some one who is but little acquainted with the names of scientific men. Although they do not in any way interfere with the real value of the book, such substitution compounds as Raoul Pietet, Sergius *Herne*, Arnandon, Allan Miller, and *Neil* (for Feil), must be regarded as blemishes which a little care might have eliminated. The volume numbers over 1000 pages, and is well and clearly printed.

We must congratulate Mr. Hunt and his assistants on the success which has attended their endeavours to present the scientific reader with the latest information regarding processes and manufactures of every description.

"Watts's Dictionary of Chemistry" and the present work are the natural complements of each other, and with their supplements form in themselves a scientific pair, which are absolute desiderata to all technological workers and institutions.

Ninth Annual Report of the State Board of Health of Massachusetts. January, 1878. Boston: Rand, Avery, and Co.

Perhaps the most generally interesting article in this issue is a paper by Dr. Joy Jeffries on the "Dangers arising from Colour-Blindness." The author explains very clearly the nature of this defect, concerning which very vague notions are still entertained even by educated persons. He points out that colour-blindness by no means involves any inability to distinguish forms. To the colour-blind all mixed tints, in proportion as they contain his faulty colour, will appear so much the darker. Where we see colour he simply sees, so to speak, its absence, an object of his faulty colour appearing to him as grey does to the normal eye. A red-blind person cannot distinguish that colour from its complementary, green. Now it might seem, at first glance, that a defect of this nature would be very easily detected. Such, however, is not the case. As Dr. Stilling remarks—"It is a well known fact that colour-blind persons, by exercising their faculty of judgment, can aid their want of sensibility, and are able to conceal their defect to a certain extent. They have learned the names of colours quite as well as normal-sighted people, and by the help of every outward sign they have acquired a certain knowledge of those pigments to the characteristic tints of which they are blind." To take an example:—A man who is red-green colour-blind will have learned, like his neighbours, that grass is green. If a blade of grass is placed before him he will recognise it by its form, and if asked its colour he will give a correct reply. If, again, we ask him the colour of a rose he will tell us, on the same principle, that it is red. There are, indeed, white roses, but these he will distinguish from the red varieties by the deeper colour of the latter, which to him will seem of different shades of grey. Hence, in order to test a supposed colour-blind person, it is necessary, not to ask him to name the colours of familiar objects, but to set him to "match off" a number of bits of cloth, or skeins of silk, or woollen yarn. If we give him, say, half a dozen shades of red and as many of green, and find that he places these respectively in two distinct groups, we may pronounce him free from the red-green form of colour-blindness. These principles the author applies to the subject which he is practically considering, viz., colour-blindness in railway officials, steersmen, military and naval officers, &c. In certain departments of manufactures and commerce this defect in vision is a fatal disqualification to the individual, but it does not constitute a source of public danger. Not so in the spheres of activity above mentioned. All vessels are now required to display from sunset to sunrise a green light on the starboard, and a red light on the port side. These lights indicate not merely the position of the vessel but the direction in which she is moving. If, however, the steersman, or the look-out, or the officer of the watch is unable to distinguish red from green this precaution is entirely useless. The exact position of a ship on nearing the coast is often known to the captain merely by the different colours of light emitted by lighthouses. But if colour-blind he confuses these indications. Hence this defect of the sight must be considered an absolute disqualification for

an officer, either in the navy or the mercantile service, and all candidates for such posts should be systematically examined in the very outset. Very similar is the case with the officials of railways. An engine-driver to whom a red flag by day or a red lamp by night appears merely like a dusky white is obviously unfit for his duties.

The question has been asked whether form might not be substituted for colour as a sign of danger whether by land or sea. By day this is of course possible, but all attempts to do away with coloured lamps as signals by night only lead to greater complication and multiply the sources of error.

The prevalence of colour-blindness is far wider than has been supposed. The results obtained by different investigators in different countries, and perhaps in some cases using imperfect tests, offer wide discrepancies. Still it would seem that, on the average, 5 per cent of the population are in a greater or less degree affected with this peculiarity. Nor is it, as was once supposed, confined to the male sex. The disease is mostly congenital and often hereditary, but it is capable of being brought on by accidents and by drunkenness.

Report on the Progress of the Iron and Steel Industries in Foreign Countries. Vol. ii. 1877. By Julien Deby, C.E., Foreign Secretary to the Iron and Steel Institute. Newcastle-upon-Tyne: M. and M. W. Lambert.

This volume gives the technology and statistics of the iron manufacture abroad, especially in America, Belgium, France, and Germany. The various procedures for the analysis of irons, iron-ores, and intermediate products here described are for the most part already known to our readers. Reference is made to a paper by M. A. Martens, who considers it practicable to determine the quality of certain varieties of iron and steel by the use of the microscope. The editor remarks, however, that M. Martens appears to have overlooked the researches of Mr. Sorby in the same direction.

The direct production of malleable iron and steel from the ore, with the ultimate suppression of the blast-furnace, is still held up as a great unsolved problem. Especial notice is made of the process of Du Puy, who, judging from the trial already made, appears to eliminate three-fourths of the phosphorus present in the ore. The inventor's theory is that as phosphorus is easily fusible, and as the non-metallic elements if combined with proper fluxes also melt at a much lower heat than the metal, the phosphorus becomes incorporated with the glassy slag of the former, and never leaves it.

Mr. C. Ryder suggests the possibility of testing the degree of carbonisation in steel by a process based on the fact that the permanent magnetism of steel is affected by the percentage of carbon it contains. He exposes the steel to a strong current, and measures the effects. He also exposes, at the same time, a piece of standard steel of known carbonisation to the same influence. He considers that by this method a better knowledge can be obtained of the properties of the steel and the uses for which it is adapted than by chemical analysis alone.

Whilst fully admitting the great value of this Report to all persons connected with the metallurgy of iron, we cannot help pointing out that its utility would be much increased by a good index, especially as the table of contents, placed where it may possibly be overlooked altogether, extends only to twenty-four lines. This deficiency makes reference to any particular passage almost impossible.

Bulletin of the Bussey Institution. Vol. ii., Part 3. 1878. Boston: John Allyn.

This issue contains an interesting paper on the hybridisation of lilies, the conclusion being that the principal species of the genus when hybridised produce offspring which show the features of the male parent very slightly, or only in exceptional cases. Such cases are, however, so remarkable at times that their rarity ought not to discourage the experimentalist.

Prof. Storer has made an elaborate examination of the shells of crabs and lobsters, in comparison with those of oysters, clams, and other mollusks, with a view to the determination of their manurial value. In none of the latter class does the proportion either of potash, phosphoric acid, or nitrogen reach even 0·1 per cent. The shells of the crustaceans, on the other hand, contain notable quantities of these valuable constituents, amounting to 3·5 per cent phosphoric acid in the lobster, and 12·7 per cent nitrogen in the king-crab.

The same able and indefatigable chemist furnishes a paper on the prominence of carbonate of lime as a constituent of solutions obtained by the percolation of water through dry cultivable soils.

COMPOSITION AND QUALITY OF THE METROPOLITAN WATER.

May, 1878.

The following are the returns of the Society of Medical Officers of Health:—

	Appearance in 2 foot Tube.	Ammonia. Saline.	Ammonia. Organic.	Nitrogen as Nitrates, &c.	Oxygen used to Oxidise Organic Matter.	Total Solids.	Lime.	Magnesia	Chlorine.	Sulphuric Anhydride.	Hardness on Clark's Scale. Before Boiling.	Hardness on Clark's Scale. After Boiling.
		Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs
Thames Water Companies.												
Grand Junction	Clear	0·000	0·009	0·120	0·066	19·40	8·170	0·360	1·01	1·600	13·2	2·80
West Middlesex	Clear	0·000	0·010	0·120	0·084	19·20	7·840	0·360	1·01	1·530	13·2	3·30
Southwark and Vauxhall	Clear	0·000	0·009	0·135	0·077	19·00	7·890	0·320	1·01	1·530	13·2	3·30
Chelsea	Clear	0·000	0·007	0·135	0·056	18·40	7·750	0·390	1·01	1·560	12·6	3·70
Lambeth	Clear	0·000	0·008	0·156	0·063	20·60	8·400	0·430	0·94	1·630	13·7	2·80
Other Companies.												
Kent	Clear	0·000	0·001	0·450	0·001	32·00	12·260	1·150	1·73	4·860	20·6	7·50
New River	Clear	0·000	0·005	0·144	0·024	17 60	7·950	0·280	1·01	1 000	12·6	3·70
East London	Clear	0·000	0·007	0·135	0·049	18·10	6·380	0·360	1·15	1·600	12·1	3·30

The quantities of the several constituents are stated in grains per imperial gallon.

Note.—The amount of oxygen required to oxidise the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the Metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it

C. Meymott Tidy, M.B

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 19, May 13, 1878.

Researches on the Law of Avogadro and of Ampère.—M. A. Wurtz.—The author infers from his experiments that dry oxalate of potassium becomes hydrated in the same manner in an atmosphere of chloral hydrate, and in an atmosphere of moist air, or chloroform containing watery vapour at the same tension as the atmosphere of chloral hydrate. Hence he concludes that the latter is entirely dissociated, for the watery vapour which it contains is absorbed sensibly in the same manner as the vapour of water freely contained in an artificial atmosphere at the same tension.

Polymerisation of Ethylen Oxide.—M. A. Wurtz.—If to oxide of ethylen a fragment of melted chloride of zinc be added, the whole becomes solid in the course of some months.

The Microphone of Mr. Hughes.—M. du Moncel.

Refraction of Organic Bodies considered in the Gaseous State.—M. Mascart.—The refraction of a gaseous mixture is equal to the sum of the refractions of the constituent gases, each of them being reduced to the total volume of the mixture, but this law is inexact for compound bodies, the real refraction of which is generally less than what the calculation would indicate. Four substances alone seem exceptional, the protoxide and binoxide of nitrogen, hyponitric acid and ammonia. The three former are endothermic, that is to say they cannot be obtained without absorption of heat, whilst ammonia is formed with liberation of heat. The cause of this increase of refraction, therefore, does not seem to depend on the sign of the thermic phenomena accompanying combination. Further hydriodic acid is also endothermic, yet the refraction of the gas follows the general rule. It appears that no method founded upon the sole consideration of elementary composition permits us to calculate the refraction of a compound from that of its elements.

Production of Sulphuretted Oils Possessing Insecticide Properties.—MM. de la Loyère and Muntz.—The oils in question are obtained by the distillation of the bituminous limestone of Orbagnoux, near Seyssel. They have been successfully used against the phylloxera.

The Telephone.—M. Izarn.—The author having set up a telephone, the wire of which is connected with two gas-burners, finds that it transmits very distinctly the signals traversing two telegraphic systems, not merely absolutely distinct from his wire, but at a considerable distance.

New Electric Incandescence Lamp, acting in the Open Air.—M. Em. Reynier.—The new electric lamp depends on the following principle: if a slender rod of carbon, pressed laterally by an elastic contact, and impelled axially against a fixed point of contact, is traversed between these two contacts by a sufficiently energetic current, it becomes incandescent in this portion, and burns tapering away towards the end. In proportion as the consumption of the end proceeds, the rod being continually propelled moves forward, so as still to abut against the fixed contact. The heat developed by the passage of the current is greatly increased by the combustion of the carbon. The model submitted to the Academy gave a clear white light with four Bunsen elements. With more powerful electric sources many lamps may thus be worked.

Reproduction of Quartz by the Dry Way.—M. P. Hautefeuille.—At the temperature necessary to maintain the tungstate of soda in fusion, about 750°, grains of amorphous silica disappear, and are succeeded by agglomerations of transparent rods, and if the heat is continued for several hundred hours, double hexagonal pyramids appear, having all the characters of the quartz.

Production of Heat by a Chemical Action.—T. L. Phipson.—If a fragment of calcic hypochlorite is held before the orifice of a tube from which issues a rapid current of sulphuretted hydrogen, the following phenomena are remarked:—All odour of sulphuretted hydrogen disappears immediately, and is succeeded by a strong smell of chlorine. A slight deposit of sulphur is formed upon the solid fragment, and the disengagement of heat is so rapid and intense that the hypochlorite can scarcely be supported in the fingers. The sulphhydric acid displaces, therefore, the hypochlorous acid, liberating chlorine as do the other hydracids; that is to say the hydrogen of these acids is burnt by the oxygen of the hypochlorous acid, the chlorine of the latter becoming free. In the present case the hydrogen is burnt so rapidly that a slight deposit of sulphur is formed upon the hypochlorite, but the bulk of the sulphur is burned to sulphuric acid at the same time as the hydrogen.

Action of Watery Vapour upon the Hydrocarbides raised to a Red Heat.—M. Coquillion.—The author has previously pointed out the increase of volume produced on passing hydrocarbides over palladium wire, heated to redness along with a proportion of oxygen insufficient for their combustion. He has now examined under what conditions and to what extent this augmentation of volume is produced. These reactions throw a light upon the part played by hydrocarbides in blast-furnaces, and show the influence of watery vapour, which facilitates their dissociation, producing at the same time a fall of temperature, which is added to that due to the transformation of carbonic acid into carbonic oxide.

Distribution of Salts in the Soil.—M. H. Pellet.—A large proportion of salts have a tendency to climb; those which descend are chiefly of a deliquescent nature, such as carbonate of potassa, and chloride of calcium; nitrate of lime, however, has a remarkable climbing tendency. The nature of the soil (coarseness or fineness of its particles, proportion of moisture, &c.), influences the ascent of salts. In one and the same soil, a part of the salts may be carried downwards by moisture, and if evaporation from the surface is resumed, may anew begin to ascend. The extreme layers of the permeable soil will always be found richest in fertilising matter, whilst the intermediate portion is impoverished. Superphosphate of lime is remarkable for its climbing powers.

Detection of Ozone in the Air.—M. G. Daremberg.—The author finds that in his observations, ozonoscopic papers were little affected at the coast line, whilst at the distance of 30 metres, the impression was much stronger. The action increases with the wind.

Justus Liebig's Annalen der Chemie. Heft 1 and 2, May 9, 1878.

The Amidines and the Monobasic Organic Acids of the Thiamides.—August Bernthsen.—In this paper the author examines at great length the amidines of monobasic organic acids, the relations between the thiamides and the amidines, and the thiamides of the monobasic organic acids. He considers it as established that the amidines of these acids behave with sulphuretted hydrogen exactly as on partial saponification by means of water. Carbon bisulphide behaves also differently with amidines than with the primary amines of the univalent alcohols: the imid-residue (NH)″ or (NR)″ is substituted for the univalent sulphur.

Communications from the University Laboratory of Prague, sent in by E. Linnemann.—These include a paper by E. Linnemann on the behaviour of propyl-glycol

on being raised to an elevated temperature in presence of water, the result being the formation of propyl-aldehyd as a product of decomposition. An essay by B. Brauner on the "Direct Conversion of Isobutyl-iodide into Trimethyl-carbinolamin;" a treatise on "Artificial Malic Acid, prepared from Fumaric Acid," by F. Loydl; a paper by Dr. O. Völker, on "Maxwell-Simpson's Synthesis of Acrolein," and one by V. v. Zotta, on "Behaviour of β-Dibrom-propionic Acid with Potassium Iodide."

Communication from the Laboratory of the University of Würzburg.—These communications comprise the following papers:—"On Vinyl-ethyl Ether," by J. Wislicenus; "Synthesis of Glutaric Acid, and α-Methyl-glutaric Acid by means of Acetic-ester," by J. Wislicenus and L. Limpach; "Synthesis of Pyrotartaric Acid by means of α-Methyl-acet-succinic-ester," by G. Kressner; "On α-β-Dimethyl-acet-succinic-ester and Symmetrical Dimethyl-succinic Acid," by Fr. Hardmuth; "On α-Ethyl-acet-succinic-ester, and Ethyl-succinic Acid," by Carl Huggenberg; "Improved Method of Preparing Single and Double Organic Substituted Acetic-esters," by Max Conrad and L. Limpach.

Optical Rotatory Power of Liquids and Dissolved Substances.—O. Hesse.—If a solvent exerts an influence upon an optically active body, the rotatory power in question furnishes a standard for the work effected by the power of permanence of the active substance, and by the intensity with which the inactive particles react upon the active ones. It must be assumed that one series of solvents will behave alike with respect to an active body dissolved and inversely, but that others will behave differently, so that one and the same body may have several limited rotatory powers. The temperature also may have an influence. Thus certain kinds of sugar may have several limited rotatory powers for one solvent. In order to determine the limited rotatory power of a substance, it is, therefore, necessary to particularise the quality of the solvent and the method of solution.

On Glucose.—O. Hesse.—The author finds that the melting-point of glucose, though not strictly constant, lies between 80° and 84°.

On Phlorose.—O. Hesse.—The author applies this name to the sugar formed according to the process of H. Schiff, by the decomposition of phlorizin with sulphuric acid. Its composition is shown by the formula $C_6H_{14}O_7$. Its melting-point is 74°, and its rotatory power $\frac{5}{6}$ that of glucose.

On Phytosterin and Cholesterin.—O. Hesse.—Phytosterin, a product obtained from the calabar bean, agrees in composition with cholesterin, *i.e.*, $C_{26}H_{44}O$, but it occasions a smaller deviation of the plane of polarisation.

Remarks on Amyrin and Icacin.—O. Hesse.—The author assigns to amyrin the formula $C_{47},H_{76}.(OH)_2$, and to icacin $C_{47}H_{77}.OH$.

On Cynanchol.—O. Hesse.—The author compares the properties of cynanchocerin, cynanchin, echicerin, and echitin, and considers that the distinguishing characteristics of these four bodies must be sought in their crystalline forms and melting-points.

Composition of the Alkaloids of Sabadilla Seed.—O. Hesse.—An examination of the composition of sabadillin, sabatrin, and veratin.

A Contribution to a Knowledge of the Alkaloid named Quinidin by Henry and de Lombre.—O. Hesse.—The author considers Delondre's quinidin as identical with the quinidin of Winckler.

On Euphorbon.—O. Hesse.—The author assigns to this substance the composition $C_{15}H_{24}O$. Its melting-point is from 113° to 114°.

Constitution of the Benzol-derivatives.—E. Wroblevsky.—A hypothetical paper which does not admit of useful abstraction.

Production of Cymol from Cuminic Alcohol.—K. Kraut.—The author admits that cymol cannot be produced from cuminic alcohol by the action of alcoholic potassa. He has obtained it, however, by submitting cuminic alcohol to prolonged ebullition with zinc-powder.

Researches Conducted in the Laboratory of Prof. F. Beilstein, at St. Petersburg.—These communications comprise the following papers:—"On the Chlorine Derivatives of Benzol," by F. Beilstein and Ap. Kurbatow; "On the Preparation of Glycol," by St. Stempnewsky; and "On the Behaviour of Chloroformic Ether with Potassium Cyanate," by Dr. Th. Wilm.

Preparation of Ethylen, and on Certain Ethen Compounds.—Emil Erlenmeyer.—The author combats the objections raised by Demole against his method of preparing ethylen, and approves of Atkinson's process for obtaining monacetin and glycol.

Gazzetta Chimica Italiana.
Fasc. ii. and iii., 1878.

Preliminary Note on Hippurate of Amyl, and Notice on Hippuric Acid.—G. Campani.—Hippurate of amyl crystallises in very minute prisms of a slightly yellowish colour, and of a faint fruity odour, heavier than water, in which they are scarcely soluble, but dissolve very readily in alcohol and ordinary ether. The melting-point is +27—28°. Amyl-hippuric ether on boiling in aqueous potash readily reproduces hippuric acid and amylic alcohol. The results of its analysis agree with the formula $C_{14}H_{13}NO_3$. The author gives 188·5° as the melting-point of hippuric acid.

Electrolytic Researches on Certain Glucosides.—Michele Coppola.—The author has investigated the electric decomposition of salicin and amygdalin. The results show that amygdalin, like salicin, is resolved by electrolysis, as by the action of dilute acids and organic ferments, into glucose, benzoïc aldehyd, and hydrocyanic acid.

Mother-Liquor of the Saline Springs of Volterra.—Dr. A. Fumaro.—The chief point to be noted is, that the water at sp. gr. 1·215 contains 21·616 grms. potash per litre.

On Nitroso-furfurin and Oxynitroso-furfurin.—R. Schiff.—Nitroso-furfurin, $C_{15}H_{11}N_3O_4$, is insoluble in water, tolerably soluble in alcohol and ether, from which it separates in large triclinar gold-coloured crystals. To oxynitroso-furfurin he gives the composition $C_{15}H_{11}N_3O_7$.

On a Reagent for Reducing Substances in General, and in particular for Glucose.—Egidio Pollacci.—The base of the reagent in question is hydrated ferric oxide, prepared and applied as follows:—Introduce into a flask 2 to 3 c.c. of distilled water, into which is put, by means of the end of a small glass rod, about half a drop of an aqueous solution of pure ferric chloride, and then three or four drops of caustic soda dissolved in distilled water, and finally is added the suhstance to be examined. This being done the mixture is shaken, heated to a boil for a minute or two, and then, after having withdrawn it from the fire, a drop of concentrated sulphuric acid is added. This having been done, the tube is cooled, by letting water fall upon it, and when the liquid is sufficiently cool, the tip of a small glass rod is introduced with half a drop of a freshly prepared solution of pure ferridcyanide of potassium (red prussiate). If the addition of the ferridcyanide does not give rise at once to the production of Prussian blue, the suspected substance contains no reducing agent. A blue colouration more or loss heavy indicates, on the other hand, the presence of a reductive substance.

Certain Decompositions of Strychnine.—R. Schiff.—Strychnine introduced into nitric acid dissolves with the evolution of heat and the production of abundance of nitrous vapours. On diluting the solution with water,

there is formed a yellow amorphous precipitate, a mixture of a base and of a neutral body. To separate these two compounds, they are dissolved in glacial acetic acid, and precipitated with water. The neutral substance is thrown down as a yellow amorphous powder, whilst the base remains in solution, and may be precipitated with sodium carbonate. This latter product appears to be nitro-strychnine. If the solution of strychnine in concentrated nitric acid is heated for some hours on the sand-bath, and allowed to cool, a yellow crystalline substance is deposited, the quantity of which is considerably increased on adding water to the liquid. This compound is an acid of the composition $C_{16}H_{11}N_4O_{15}$.

Action of Hydriodic Acid upon Olivile.—D. Amato.—The author has obtained several products the nature and properties of which are not yet determined.

On Certain Reagents for Glucose.—Dr. G. Mazzara.—The author mentions nickel sesquichloride as a very sensitive reagent, its reduction to protoxide being marked by the change of colour. He places a little of the sesquioxide in a test-tube, adds a little of a solution of potassic hydrate, and on heating along with the smallest quantity of glucose the sesquioxide is at once converted into a green powder. This reduction, however, like that of ferric oxide, takes place in presence of many organic bodies.

Formation of Digallic Acid, and on the Nature of Tannin.—H. Schiff.—A polemical paper of little general interest.

On β-Chlorobutyric Acid and some of its Derivatives.—Luigi Balbiano.—The author examines the chlorobutyrate of ethyl and oxybutyric acid, pointing out the characteristic reactions of the normal acid, of the α and β varieties, and of that obtained from chlorobutyric ether.

Action of Anhydrous Sulphurous Acid upon Alcohols.—Stefano Pagliani.—The acid having been treated along with ethylic alcohol to 180° in a sealed tube, the liquid, on the addition of water, deposited a white sediment of sulphur. On saturation with baryta, and distillation, a liquid was obtained having the odours of ether and mercaptan. The filtrate contained not a trace of a barytic salt. On prolonged action at a higher temperature, the products formed were sulphur, ether, sulphydrate of ethyl, and ethylo-sulphuric acid.

Guaiacum-Resin considered as a Reagent for the Salts of Copper.—Enrico Purgotti.—Schœnbein pointed out that the compounds of copper in presence of hydrocyanic acid or of cyanides produce indirectly the reactions of ozone, and in particular that of giving a blue colour with tincture of guaiacum. The author finds that beside the cyanides, ferro-cyanides, nitro-prussiates, sulphocyanides, the alkaline and alkaline-earthy chlorides produce the same effect.

Fatty Matter of Vateria Indica.—Prof. Giovanni Dal Sie.—A lengthy paper, not suitable for abstraction.

Calamine Rich in Indium.—A. and G. De Negri.—The calamine in question is that from the mine of Oneta, in the province of Bergamo.

Analysis of the Iodo-bromic Mineral Water of Casteggio.—A. and G. De Negri.—An exceedingly complex water, containing in addition to the more common constituents, lithium, rubidium, cæsium, cobalt, bismuth, and zinc.

Temperature of Flames.—F. Rossetti.

Determination of the Proteinic Matter in Forage.—Fausto Sestini.

On Liquorice Root.—Fausto Sestini.—None of these papers are capable of useful abstraction.

Reimann's Färber Zeitung,
No. 19, 1878.

This issue contains the conclusion of the paper on "malachite-green." It is remarked that this colour is distinguished from methyl green by its greater power of resisting soap, acids, and high temperatures; that it can be applied upon wool in a slightly acid bath, and can, therefore, be used along with picric acid, and other dyes of a similar nature. The wool does not require any preparatory mordant, but a little hyposulphite of soda and mineral acid are added along with the dye.

The rest of the issue is chiefly taken up with an account of Kallab's patent process for bleaching wool with the hydrosulphite of soda.

Les Mondes, Revue Hebdomadaire des Sciences,
No. 3, May 16, 1878.

M. Navez criticises the assertion ascribed to M. du Moncel, that the audible vibrations of the telephone are produced by the metallic nucleus of the instrument even without the vibrating plates. If like M. du Moncel, Mr. Spottiswoode has found these plates useless, it is because in the execution of his experiments he placed himself in circumstances proper for the propagation of sound by intermolecular vibrations. M. du Moncel claims the invention of the telephone for M. C. Bourseulles, sub-inspector of telegraphic lines at Auch. The idea of causing plates to vibrate at a distance entitles M. Bourseulles to rank among the precursors of Bell and Edison, but nothing further.

M. Maiche suppresses the metallic sound of the human voice as transmitted by the telephone by stretching before the magnetised bar a film of caoutchouc of 4 centimetres at most in diameter by 1 millimetre in thickness, upon the centre of which he cements a disc of tinned iron of the same thickness and of 3 centimetres in diameter.

Moniteur Scientifique Quesneville.
May, 1878.

On Cadaveric Alkaloids, and on their Importance in Toxicology.—Prof. F. Selmi.—In the course of toxicological experiments the author has discovered, in extracts obtained from the bodies of persons who had died naturally, several substances possessing the general characters of the alkaloids, and has found that they are derived from the spontaneous decomposition of the cadaveric matter. Some of them are fixed, and others volatile; some are soluble in ether; others insoluble in that medium, but soluble in amylic alcohol; and others, again, insoluble in both these liquids. Generally the fixed cavaderic alkaloids yield a precipitate with almost all general reagents. Some of them are precipitated by platinic chloride, with argento-potassic cyanide, and with potassic bichromate. They may give rise, with iodureted hydriodic acid, to crystalline compounds often resembling those formed by the same reagent with certain vegetable alkaloids. They yield coloured reactions which, however, in certain cases are not produced according to the conditions of putrefaction. Of these coloured reactions the following are the principal:—Sulphuric acid, moderately concenrrated, gives a red-violet colouration. Hydrochloric acid, mixed with sulphuric acid and applied hot, a red-violet. Sulphuric acid and bromine water, a red colouration more or less distinct, which fades after a certain time. Nitric acid, gently heated and followed by potassa, gives a beautiful golden yellow. Iodic acid, sulphuric acid, and bicarbonate of soda form a violet-rose more or less distinct. These compounds are easily oxidised, and turn brown on exposure to the air, evolving a special urinous odour; at other times the smell is like that of conicin, and sometimes they exhale a perfume like that of certain flowers. They generally possess a pungent taste which benumbs the tongue; in some cases the flavour is bitter. Some of these compounds have no injurious effects upon animal life, but others are powerfully poisonous. The symptoms produced are transient

dilation of the pupils, slackening and irregularity in the pulsations of the heart, and convulsions. After death the heart is found contracted and void of blood.

Constitution of Ultramarine.—Jul. Philipp.—The author finds that green ultramarine may be transformed into the blue variety by the action of boric acid, of sal-ammoniac, and of chlorine. These facts seem to favour the view that green ultramarine differs from the blue by containing an additional proportion of sodic sulphide.

Extracts of Tannin.—A notice of the chief astringent extracts now met with in commerce. Among the principal kinds mentioned are the Mimosa-bark extract from Australia; that of so-called hemlock-bark (*Abies Canadensis*) from Canada and the United States, of which, in 1875, 6000 tons were imported into England. Extract of chestnut-wood is made by several firms in France and Germany, and contains about 18·5 per cent of actual tannin. In Jamaica a tanniferous extract is prepared from the leaves and branches of the pimento; and at Portland, in the State of Maine, the so-called sweet-fern (*Comptonia asplenifolia ?*) has been brought into use for the same purpose.

Regeneration of Deteriorated Albumen.—Albumen which has become partially insoluble may be restored by treatment, at 40°, with water containing 2·5 per cent of hydrochloric acid and 7·5 per cent of the stomachs of calves or sheep cut into shreds, the active principle being pepsine. After digestion for thirty-six hours the liquid is filtered off, and neutralised with ammonia.

MISCELLANEOUS.

Russian Scientific News.—Prof. Schöne has executed certain experiments referring to the action of hydrogen dioxide on oxygen compounds of thallium. It appears that the hydrogen dioxide in solution, or in the state of vapour, transfers Tl_2O into a brown insoluble thallic oxide. Thallious reagent-papers turn brown in the presence of ordinary air. This was before attributed to the action of atmospheric ozone; but as Schöne found that hydrogen dioxide has the same action on these papers, the presence of ozone in the air certainly cannot be strictly determined by means of them.

M. Eltekoff has obtained by the action of water and lead oxide on diamylen, a keton, $C_{10}H_{20}O$, boiling at 192° to 194°.

M. Wreden has transferred ordinary camphor by the action of dilute hydrochloric acid at 190° into a liquid isomer boiling at 187° to 193°, with a specific gravity 0·913 (at 0°). The compound only condenses at −17°, and solidifies at a much lower temperature. Such a solution absorbs oxygen from the air, especially in sunlight. The isomeric compound, on being boiled with an ammoniacal solution of silver nitrate, yields no silver mirror. At present the author is working out the theory of the formation of this curious compound.

SERGIUS KERN, M.E.

St. Petersburg.

American Association for the Advancement of Science.—Through the kindness of Dr. H. Carrington Bolton, we are able to announce that the twenty-seventh meeting of the association will be held at St. Louis, Missouri, commencing on Wednesday, the 21st of August, 1878. The following are the officers of the St. Louis meeting:—President—O. C. Marsh, of New Haven. Vice-President, Section A—R. H. Thurston, of Hoboken. Vice-President, Section B—A. R. Grote, of Buffalo. Chairman of Permanent Subsection of Chemistry—F. W. Clark, of Cincinnati. Chairman of Permanent Subsection of Microscopy—G. S. Blackie, of Nashville. Permanent Secretary—F. W. Putnam, of Cambridge. General Secretary—H. Carrington Bolton, of Hartford. Secretary of Section A—F. E. Nipher, of St. Louis. Secretary of Section B—George Little, of Atlanta. Treasurer—William S. Vaux, of Philadelphia.

Tokio University, Japan.—We have received from Mr. R. W. Atkinson the calendar of the Tokio University, Japan, which shows that the University is doing a great and useful work. In addition to the Law and Science departments (the latter including chemistry, engineering, mining, and biology), the hospital and medical school, under the charge of the educational department, have been incorporated with the University, and a department of literature, history, and philosophy has been formed. There are thus, at the present time, four faculties—law, science, literature, and medicine; and in accordance with this extension, the Japanese name has been altered from "Kai-sei-Gakko" to "Tokio Dai Gaku," the highest title which the language contains, and as far as it is possible to translate it into English, best rendered by "Tokio University." Before entering the University, the student has to pass through a four-years' course in the preparatory department, called the Yobimon, and, after a suitable and satisfactory examination is admitted to the Dai Gaku, the course of which is also of four years' duration, the subjects of the first year being the same for all students. At the conclusion of this year, the student states into which course he wishes to be admitted, and he thus receives three years' training in the official subject which he selects. Three students, last year, finished the three years course in chemistry. These are the first graduates which Japan has produced in her own country. The number would probably have been greater but for the fact that out of an original class of nine, five students were sent abroad to study, and one received an appointment in the country. The remaining three completed the course with satisfaction, and received their graduating certificates. An important part of the final examination is the composition of a thesis upon some chemical or technical subject connected with the country, each student being at liberty to choose his own subject, and during the last half-year to work at it experimentally in the laboratory. The three essays given in last year were on "Dyeing," "Pottery and Porcelain," and "Sugar," all of which showed a considerable amount of work done in the laboratory; the first, especially, treated of a good deal of new matter, as, hitherto no scientific examination of the dye-wares used in Japan has been made, and it was consequently necessary to identify each one. Last spring, evening lectures were commenced, and were continued through the winter session. Two are given in one month, one being in English, and the other given by one of the Japanese lecturers in their own language. They are well attended, the lecture hall, which holds about 500 persons, being usually crowded.

NOTES AND QUERIES.

Formic and Acetic Acids.—What is the best test to distinguish between formic and acetic acids, or to discover one of them if mixed with the other?—H. B. G.

Distillation of Shales.—Will any of your readers tell me the name of the best book on the distillation of shales, and the manufacture of mineral and the like kind of oils.

MEETINGS FOR THE WEEK.

MONDAY, June 24th.—Royal Geographical, 8.30.
TUESDAY, 25th.—Anthropological Institute, 8.
WEDNESDAY, 26th.—Society of Arts, 4. Anniversary.
— Society of Public Analysts, 8. "On the Detection of Alum in Flour," A. Wynter Blyth. "On the Assay of Carbolic Acid Powders," A. H. Allen. "Note on the Detection of Alum in Flour," Dr. Dupré. "Preliminary Note on the Nitrogen Salts contained in the Cereals," G. W. Wigner. "On the Detection of Alum in Flour," W. C. Young.
THURSDAY, 27th.—Royal Society Club, 6.30. Anniversary.
FRIDAY, 28th.—Quekett Club, 8.

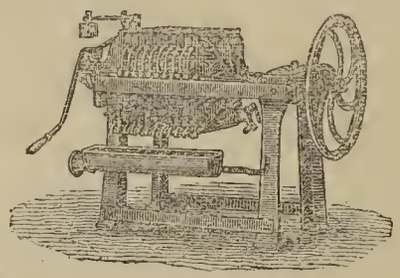
A. L. G. DEHNE'S FILTER-PRESSES.

(HALLE-ON-SAALE, GERMANY.)

THE speciality of these Presses is that they have ONLY ONE COMPRESSION SCREW, and this is worked by HAND-WHEEL. They are in other respects of the best materials and the most improved construction.

NEARLY 3000 ALREADY SOLD AND DELIVERED TO

SUGAR REFINERIES
POTTERIES and CLAY WORKS
PARAFFIN WORKS
STEARINE WORKS
OIL REFINERIES
DISTILLERIES
BREWERIES
&c.



CHEMICAL WORKS
ANILINE WORKS
ALIZARIN WORKS
WHITE LEAD WORKS
COLOUR WORKS
STARCH WORKS
YEAST FACTORIES
&c.

These Presses are confidently recommended for STRENGTH, POWER, SIMPLICITY, EASE IN HANDLING and for the perfection of their results—(1). In such a *Separation of Liquids from Solid Materials* as has hitherto been attainable only by Hydraulic Pressure, Centrifugal Machines, Evaporation, or Precipitation. (2). In the *Clarification of Liquids*, as in the manufacture of Oils, Wines, Beers, and in Chemical Processes. (3). In the *Thorough and Complete Lixiviation* and extraction of soluble from insoluble matters. The exclusive right to the arrangements for this last-mentioned purpose is secured to A. L. G. Dehne by LETTERS PATENT in his favour. These Presses are made of different materials and with requisite modifications of construction TO SUIT SPECIAL REQUIREMENTS.

All communications to be addressed to the SOLE AGENTS FOR THE UNITED KINGDOM—

B. H. REMMERS & CO., 63, West Regent Street, Glasgow,

Who will show a Press in operation, supply Illustrated Catalogues, and give all necessary particulars.

MINERALS FOR CHEMISTS, &c.

NEW AND REVISED LIST, with Prices of Minerals containing rare Elements, &c., for Chemical Purposes, Experiment, and Research. Also, Elementary Collections of Minerals, Fossils, and Rocks, for tudents, Schools, Colleges, &c.

NEW PATTERNS OF GEOLOGICAL HAMMERS.
NEW CATALOGUE OF SECONDHAND AND NEW BOOKS, NOW READY.

JAMES R. GREGORY,
MINERALOGIST,
88, CHARLOTTE STREET, FITZROY SQUARE

PROFESSOR HUGHES'S MICROPHONE.

Six Daniell Cells and Materials for Constructing Microphone for 21s.; carriage paid to any part of England. Telephones fixed or exhibited. Electric Bells, and all descriptions of Electrical Apparatus for Telegraph and for Experimental Purposes. —Edward Paterson, Electrical Engineer, 3, Bedford Court, Covent Garden, W.C.

Methylated Spirits.—David Smith Kidd Licensed Maker, Commercial Street, Shoreditch, N.E Also FINISH, FUSEL OIL and RECT. NAPHTHA

Ryall's Chemical Black Lead (Registered) creates no waste or dust by its magnetic adherence to the stove and the cleanliness of application makes this one of the marvels o household economy.—Sold by all respectable grocers and oilmen in blocks 1d., 2d. 4d. and 1s. boxes. Works, 9½, Little Compton Street, Soho, London.

PROF. HUGHES'S MICROPHONE,

Price 10/6, 15/, 21/.

The 10s. 6d. is a neat instrument in polished mahogany case for the table or pocket.

The 15s. is a more sensitive instrument. It will magnify delicate sounds, and render audible sounds, such as the tramp of a fly in walking.

The 21s. instrument include a 3-cell battery and 10 yards of conducting wire.

M. JACKSON & CO.,
65, BARBICAN, LONDON, E.C.

SCIENTIFIC APPARATUS MANUFACTURERS.

Price Lists 3d. and 1s. each.

SPECIALITIES.

MANGANESE	Lump, Crystallised, Ground, and Prepared Large stock of every description. *** *Suitable for all Trades.*
ARSENIC	Refined powdered, Lump, Grey, and Ruby.
FLUOR-SPAR	Finest produced. Medium and Common for all purposes.
BARYTES	Carbonate and Sulphate. All qualities of Lump and Ground.
BAUXITE	Of high percentage of Alumina and low in Iron;

CRYOLITE, MAGNESITE, CHROME ORES, EMERY STONE, AND ALL MINERAL ORES &c.

GEO. G. BLACKWELL,

MINERAL AND CHEMICAL BROKER,

5, CHAPEL STREET, LIVERPOOL

NOTE.—SPECIAL ATTENTION is directed to my CARBONATE AND SULPHATE OF BARYTES as the *finest* produced, being clean, crystallised, free from Lime, and of the *highest test.*

MANCHESTER CORPORATION GAS-WORKS.

AMMONIACAL LIQUOR.

The Gas Committee of the Corporation of Manchester are prepared to RECEIVE TENDERS for the PURCHASE of the AMMONIACAL LIQUOR to be produced at their Gaythorn and Rochdale Road Works during a period of one or more years, commencing from the 1st day of January, 1880. In addition to tenders for the purchase of the liquor in its crude state, the Committee will also be prepared to consider tenders for its disposal, either by manufacture into sulphate of ammonia at the above-mentioned works on their behalf, or in any other manner. The Committee reserve to themselves the option of accepting the offer the terms of which they deem most advantageous. They do not bind themselves to accept the highest or any tender. Sealed tenders, addressed to the Chairman of the Gas Committee, Town Hall, and endorsed "Tender for Ammoniacal Liquor," must be delivered at these offices on or before Thursday, the 1st day of August next.—Forms of tender and further particulars can be obtained on application to Mr. George B. Jackson, at the Gas Offices.—By order of the Gas Committee,

JOSEPH HERON, Town Clerk.

Town Hall, Manchester, 31st May, 1878.

THE CHEMICAL NEWS.

VOL. XXXVII. No. 970.

ON AREOMETERS.*—PART II.

By P. CASAMAJOR.

(Continued from p. 244.)

Correction of the Indications of Areometers for Errors Resulting from Variations of Temperature.

THE methods that I propose to give for the correction of the indications of areometers, when observations are made at temperatures differing from the normal, are applicable to all liquids; but, as I am not in possession of accurate data relating to the expansion of other liquids than pure water and sugar solutions, I shall confine myself to these. The application to any other liquid, however, is equally easy, if we possess sufficient data on its expansion by heat.

I propose to consider temperatures from 5° to 45° C. only, as these limits need never be exceeded in our laboratories.

At our December meeting† I gave the following table, of which the first column contains the degrees Centigrade from 5° to 45°; the numbers of the second column represent the total *absolute* contractions and expansions of 1 c.c. of water at every degree of temperature, starting from 15° C. as a normal, and the numbers of the third column represent the total *relative* expansions and contractions for the same temperatures. These last numbers were obtained by subtracting 0·000026, the cubic expansion of glass, as many times from the corresponding numbers of the second column, as there are units *minus* 15, in the number expressing the degree Centigrade. The numbers in this third column represent the visible expansion of water in glass vessels.

TABLE No. I.—TOTAL EXPANSION FROM 15° C.

Degrees C.	Absolute Expansion.	Relative Expansion.	Degrees C.	Absolute Expansion.	Relative Expansion.
5.	0·000878	0 000612	26.	0·002445	0 002159
6.	0·000856	0·000622	27.	0·002717	0·002405
7.	0·000820	0·000612	28.	0·002995	0·002657
8.	0·000772	0·000590	29.	0·003279	0·002913
9.	0·000706	0·000550	30.	0·003569	0·003179
10.	0·000622	0·000492	31.	0 003869	0·003453
11.	0·000524	0·000420	32.	0·004181	0·003739
12.	0·000412	0·000334	33.	0·004503	0·004035
13.	0·000288	0·000236	34.	0·004836	0·004342
14.	0·000150	0·000124	35.	0·005180	0·004660
15.	normal	normal	36.	0·005533	0·004987
16.	0·000173	0·000147	37.	0·005895	0·005323
17.	0·000357	0·000305	38.	0·006265	0·005667
18.	0·000551	0·000473	39.	0·006644	0·006040
19.	0·000756	0·000652	40.	0·007032	0·006382
20.	0·000971	0·000841	41.	0·007428	0·006752
21.	0·001119	0·001039	42.	0·007832	0·007130
22.	0·001428	0·001246	43.	0·008244	0·007516
23.	0·001670	0·001462	44.	0·008664	0·007910
24.	0·001920	0·001686	45.	0·009092	0·008312
25.	0·002179	0·001919			

Referring again to the paper read before this Society in December, I will recall to your memory that by drawing a series of parallel equidistant lines, intersected another series of similar lines perpendicular to the first, by making the space between two vertical lines equivalent to 1° C., and the space between two horizontal lines equivalent to 0·0001 c.c., we were able to simplify the work of correcting the errors due to changes of temperature. We took on every vertical line a distance equivalent to the relative expansion corresponding to the temperature represented by that line, and we connected all the points thus obtained by a curve. Afterwards, by noting the points at which the curve intersects the horizontal lines representing 0·0005, 0·001, 0·0015, 0·002, 0·0025, &c., we were able to find the temperatures corresponding to these expansions as follows:—

TABLE No. II.

−0·0005	corresponds to	9·9°	Centigrade.
0·	,,	,, 15·00	,,
0·0005	,,	,, 18·20	,,
0·001	,,	,, 20·75	,,
0·0015	,,	,, 23·20	,,
0·002	,,	,, 25·30	,,
0·0025	,,	,, 27·30	,,
0·003	,,	,, 29·40	,,
0·0035	,,	,, 31·20	,,
0·004	,,	,, 32·80	,,
0·0045	,,	,, 34·50	,,
0·005	,,	,, 36·10	,,
0·0055	,,	,, 37·60	,,
0·006	,,	,, 38·80	,,
0·0065	,,	,, 40 40	,,
0·007	,,	,, 41·60	,,
0·0075	,,	,, 42·90	,,
0·008	,,	,, 44·20	,,
0·0083	,,	,, 45·00	,,

To enable us to make use of the data contained in Tables No. 1 and No. 2, let us examine what happens with an areometer floating in a liquid, when the density of the liquid varies on account of a change of temperature.

If we suppose that the temperature increases, the liquid will expand, and the areometer also, but everything will take place as if the volume of the areometer remained constant, and the expansion of the liquid was equal to the relative expansion of water in glass.

If we have an areometer which indicates specific gravities, and if we place it in pure water, at the normal temperature, 15° C., the instrument will sink to a point marked 1. If the temperature increases, the specific gravity of the liquid diminishes, and the areometer sinks deeper in the liquid. If, for instance, the temperature of the water is 35° C., we will find in the third column of Table No. 1 that at 35° 1 c.c. becomes 1·00466; consequently at 35° the specific gravity of water is—

$$\frac{1}{1{\cdot}00466} = 0{\cdot}9953.$$

As, before we have done with this subject, we shall have to correct the errors due to variations of temperature in the case of pure water, please to observe that, if the temperature is 35° C., and the indication of the areometer 0·9953, we will obtain the true specific gravity by multiplying 0·9953 by 1·00466.

I may also call to your attention that the correction may be more easily made by simply adding 0·00466 to 0·9953, which gives 0·99996, which is very approximately equal to 1.

If we wish to make use of Table No. 2, let us suppose that the temperature is 20·75°, at which 1 c.c. becomes 1·001 c.c. The specific gravity will then be—

$$\frac{1}{1{\cdot}001} = 0{\cdot}99908.$$

(very approximately 0·999). In this case we may rectify this indication of the areometer by multiplying it by 1·001. Please to notice, however, that the correction is, as above, more easily obtained by adding to 0·999 the number 0·001, placed opposite to 20·75° (0·999 + 0·001 = 1).

In the same way, if the temperature is 44·2° C., we find,

* Read before the American Chemical Society May 3, 1877.

† See CHEMICAL NEWS, vol. xxxv., pp. 130, 160, and 170.

opposite to it, the expansion 0·008, and the specific gravity of water becomes—

$$\frac{1}{1{\cdot}008} = 0{\cdot}99206,$$

very approximately 0·992. We may notice, again, that the correction is easily made by adding to 0·992, the expansion 0·008 placed opposite 44·2° C.

We may then make use of Table No. 2 by simply adding the numbers opposite to the temperatures observed, to obtain the correct reading at 15° C., in the case of pure water.

In the table marked No. 2 we have not, as in Table No. 1, every degree of the scale, but as the expansions corresponding to the temperatures in that table only differ by a quantity equal to 0·0005 c.c., no appreciable error is committed by taking the temperature in the table which comes nearest to the temperature observed.

Let us now take the case of an areometer with an even scale, and examine what happens when the liquid in which it floats is submitted to a change of temperature. If we had an areometer which would sink in pure water at 15° C., so that the liquid displaced was equal to 1 c.c., when the temperature of the water increased it would sink deeper, the extra volume of liquid displaced being equal to the relative expansion at the temperature observed, as shown in the third column of Table No. 1. If the volume of water displaced at 15° C. was 2 c.c., the increased volume of water to buoy up the areometer would be, for any temperature, the relative expansion of 1 c.c. at that temperature multiplied by 2. In more general terms, if the volume of water displaced at 15° C. was N cubic centimetres, the additional volume at any temperature would be the relative expansion, at that temperature, multiplied by N.

We have seen, however, that the divisions of an even scale are only equal volumes into which the total volume of the areometer is divided. Therefore, if we have an areometer with a total number of degrees, N, we may obtain the correction in degrees at any temperature by multiplying the total relative expansion at that temperature (Table No. 1, third column) by N, the total number of degrees.

In the preceding remarks I have always supposed that the temperature observed was above 15° C. If the temperature is below 15°, a contraction takes place, which is to be subtracted.

We may now proceed to apply the principle I have established to the correction of errors due to changes of temperature in the case of sugar solutions.

(To be continued.)

NOTE ON THE FERMENT-THEORY OF NITRIFICATION.*

By F. H. STORER, Harvard University.

The results of the following experiments bear so immediately upon the recent observations of Schlösing† and Warington,‡ noticed in the April number of this Journal, that I am led to publish them by themselves, out of their legitimate connection with other experiments upon which I have been for some time engaged. My experiments were made for the purpose of testing the action of certain oxidising agents on ammonium compounds, and they are, perhaps, not the less interesting as a contribution to the ferment-theory of nitrification, inasmuch as they were undertaken without any reference to the observations of Schlösing, and not at all with the view of supporting or even of testing his experiment.

For my first trial, eleven common glass bottles of greenish tint, each of 500 c.c. capacity, and fitted with corks carrying inlet and outlet tubes, were charged as follows:—No. 1, with distilled water that had been carefully freed* from nitrates, nitrites, and ammonium compounds: No. 2, with a solution of ammonium chloride, containing 2-10ths m.grm. of NH_3 to the centimetre; No. 3, same as No. 2, with the addition of a quantity of ferric hydrate; No. 4, same as No. 2, with the addition of ferrous hydrate; No. 5, same as No. 3, with the addition of charcoal made from white sugar; No. 6, ammonium chloride, black oxide of manganese, and sugar charcoal; No. 7, leached peat and pure water; No. 8, leached peat and ammonium chloride; No. 9, leached peat and ferric hydrate: No. 10, leached peat, ferric hydrate, and ammonium chloride; No. 11, pure water.

Pure water was used in each case to dissolve or suspend the chemicals, and the absence of nitrates and nitrites was proved by testing each of the solutions and mixtures with iodo-starch, at the beginning of the experiment.

The bottles were about half filled with liquid, *i.e.*, each of them contained about 250 c.c. of the solution or mixture allotted to it.

The "leached peat" was prepared from some bog-meadow mud from the Bussey farm, which had been kept in barrels in a dry store-room for three or four years. This thoroughly air-dried substance was percolated with pure water until the filtrate gave no reaction for nitrites or nitrates.

The ferric and ferrous hydrates were used in the recently precipitated condition; they were made from the corresponding chlorides by precipitating with ammonia-water, in the cold.

The bottles were connected with one another, in the order indicated, with short pieces of caoutchouc tubing in such manner that by aspirating at No. 1 air could be made to bubble through the water in each member of the series. The corks of the bottles and the caoutchouc connectors were covered with shellac in alcohol, so that the entire apparatus was completely air-tight; that is to say, none of the solutions had the least connection with the external air, excepting as it was purposely admitted at the inlet-tube. To purify the air that was drawn into the apparatus, it was made to pass through a long tube loosely filled with clean cotton-wool; through two sets of Liebig bulb-tubes filled with a tolerably strong solution of yellow prussiate of potash, to remove ozone; through two sets of similar bulbs charged with potash-lye, to remove nitrates and nitrites; through a dry bottle, to catch liquid drawn forward from the potash bulbs; and through a large drying tube charged for two-thirds its length with calcium chloride and one-third with soda-lime.

By means of a Bunsen filter-pump a rapid current of air from out-of-doors was drawn incessantly night and day, through the series of bottles, for a fortnight, in September, 1877, in the direction from No. 11 to No. 1; at the end of which time the contents of each bottle were tested for nitrites and nitrates, by boiling with cadmium, distilling with acetic acid, and mixing iodo-zinc starch and acid with the distillate. 100 c.c. of liquid were taken for each of the tests, and fifteen minutes were allowed in which to watch for the appearance of the blue colouration. Nothing could be more distinct and decisive than the results of these tests. The solutions from bottles Nos. 8, 9, and 10, namely, gave immediate and strong reactions for the nitrogen oxides, while the contents of Nos. 1, 2, 3, 4, 5, 6, and 11 gave no reaction whatsoever. No. 7 gave a reaction, but not a very strong one. The reaction seemed to be strongest in the contents of No. 10. It appeared from these results that there had been formation either of a nitrate or nitrite in each of the bottles which contained humus, and no such formation in either of the other bottles; but the thought suggested itself that the small amount of nitrogen oxides found in No. 7 may per-

* From the *American Journal of Science and Arts*, vol. xv., June, 1878.

† *Comptes Rendus*, lxxxiv., 301.

‡ *Journal of London Chem. Soc.*, 1878, i., 74.

* In the manner described in the note on page 182 of vol. xii. of the *Amer. Journ. Sci. and Arts.*

haps have been dragged over mechanically from No. 8 by the current of air.

A second series of tests was made upon Nos. 8, 9, and 10, to see which of them gave the weakest reaction, 25 c.c. of liquid being taken from each bottle and diluted with pure water to the volume of 100 c.c. before applying the test. It appeared again that No. 10 gave the strongest reaction, and that No. 8 gave the weakest. Roughly estimated, the strength of the reactions from jars Nos. 10, 9, and 8 were to one another as 5 : 2 : 1.

It may here be said that humus was employed in these experiments for the sake of testing the old observation of Millon,* who noticed that ammonium salts are changed to nitrates when in contact with oxidising humus, and who argued that the chemical action, originated by the coming together of humus and oxygen, was communicated to the ammonium compound. In his own words—"The oxidation of the humic acid is the cause of the oxidation of the ammonia."

In so far as the foregoing experiments go, we have manifestly a striking confirmation of the accuracy of Millon's work. But on repeating the experiments—with the difference that the bog-earth was henceforth exhausted with hot, strong, muriatic acid, before proceeding to wash it with water—no such results as the foregoing were obtained. For example, in a second series of trials, arranged like the first, the contents of bottles Nos. 1 to 6 were identically the same as before, only that the amount of liquid was now 150 c.c. instead of 250 c.c. No. 7 contained the purified peat mixed with water; No. 8 was the same as No. 7, plus a quantity of gypsum; No. 9 was the same as No. 8, plus some ammonium chloride; No. 10 contained water alone; No. 11, purified peat, plus ammonium chloride and ferric hydrate; No. 12, well-washed cotton rags, plus ammonium chloride and ferric hydrate; No. 13, purified peat, plus ammonium chloride; No. 14, pure water; No. 15, pure water, the same, namely, which had already done service (as No. 11) in the first series of experiments.

The weather (October 13, 1877) being too cold to permit the keeping open of a window, the current of air, purified as before, was drawn from the cold-air box of the hot-air furnace used for warming the laboratory. The current of air passed this time in the direction from No. 1 to No. 15; it was maintained constantly during ten days, and the contents of the bottles were then tested as before for nitrites and nitrates. But no reaction was obtained in either instance, with the exception of No. 12 (cotton rags, &c.), which gave a faint colouration of a not very satisfactory character. After the application of the test, those of the bottles which still contained a sufficiency of liquid were re-attached to the aspirator, and air was drawn through them continually during another week, when the test for nitrites and nitrates was again applied. But in no case was there any reaction, with the exception of bottle No. 8, whose contents gave a faint colouration.

Inasmuch as warm, and, at times, hot summer weather had prevailed during the term of the first series of experiments, while the out-door air was decidedly cool, and that of the laboratory by no means very warm during the time allotted to the second series, a third set of trials was undertaken in December, 1877, in which the contents of the bottles where heated artificially. That is to say, the bottles were immersed in a large water-bath, which was heated to from 70° to 80° C. during the progress of the experiment.

In this third series, there were eight bottles containing the purified peat, first by itself, then admixed with gypsum; with gypsum and ammonium chloride; and with ammonium chloride and ferric hydrate. One bottle contained washed cotton rags, ammonium chloride, and ferric hydrate as before. The water-bath was heated during working hours for a fortnight, perhaps a hundred hours in all, and during this time air was drawn from the furnace-box and purified as before. The contents of the bottles were then tested for nitrites and nitrates, but no reaction was obtained in either case. To make sure that the absence of the reaction was not due to any interference caused by the presence of the peat or the chemicals, a fresh portion of liquid was taken from each of the bottles; enough nitrate of potash to amount to 0·001 grm. of N_2O_5 was added, and the test for nitrites and nitrates was applied in the usual way: reactions were now obtained immediately in every instance.

In the light of the facts observed by Schlösing, the natural inference from the results of these experiments is that the formation of nitrates or nitrites in bottles Nos. 7 to 10 of the first series of experiments was due to the presence of living organisms which the peat had harboured, and that the absense of nitrification in the other series of experiments is to be attributed to the destruction of the ferment-germs by the hot acid with which the peat employed in these experiments had been treated. It is to be observed, moreover, that the formation of nitrogen oxides in the bottles Nos. 7 to 10 is in nowise out of accord with the important fact observed by Warington, that darkness* is essential to the action of the nitrifying germs, for although my bottles were not shielded from diffused daylight, the mixtures of peat and water which they contained were practically dark coloured muds, not ill-fitted to shelter the germs from the light.

It is possible of course that the colder weather which prevailed during the later trials may have had an influence upon their results: but if this be so, the fact must be counted as an additional argument in favour of the ferment theory. Moreover, it may fairly be inferred that if mere oxidation be all that is needed to induce nitrification, the heating of the liquids by day in the third series of experiments would have been sufficient; though both the strong heat and the cooling of the bottles by night would have tended to prevent the growth of living organisms.

In the interest of the ferment theory, it would have been well to control the negative results above given by trials with mixtures of the purified peat and carbonate of lime, for peat which has been treated with muriatic acid has always a slight acid reaction, due I suppose to free humic acid, no matter how thoroughly it may have been washed with water, and it is to be supposed that this acid peat, devoid withal of phosphatic and other saline matters, is not favourable for the growth of the ferment. But, as was said before, my experiments were made to test the oxidising action of certain chemicals, not to cultivate living organisms.

It may be added that I have not as yet found any evidence that solutions of ammonium compounds can be oxidised to nitrites or nitrates by means either of ferric

* Kopp and Will's *Jahresbericht der Chemie*, 1860, xiii., 101, and 1864, xvii., 158.

* The following statement has a certain interest for analysts as bearing upon the stability of dilute solutions of ammonium chloride. In February, 1877, it was noticed by my assistant, Mr. Lewis, that a solution of ammonium chloride, which had been prepared ten or twelve months previously for use in connection with Nessler's test, by dissolving the salt at the rate of 3·15 grms. to the litre, now gave a strong reaction for nitrites, although freshly prepared solutions, made in the same way from like materials, gave no reaction. The old solution was contained in a glass stoppered vessel, which was about half-filled by it, and it had been kept most of the time in a dark cupboard.

Acting on the supposition that the change of the ammonium salt to a nitrite had been caused by the growth of some fungus in the liquid, and that such fungus might perhaps be present in other bottles in the neighbourhood, I collected as many different specimens of moulds as could be found growing in the various saline solutions kept in the laboratory, and, after rinsing with pure water, placed them in a series of half-gallon bottles, into which had been poured from half to quarter of dilute ammonium chloride, such as is used for Nesslerising. A quantity of mother of vinegar also was placed in a similar bottle. This series of bottles was left to stand during early autumn, and winter in a greenhouse, in a rather strong light, and the solutions were tested from time to time, at intervals of three or four weeks, but no reaction for nitrites or nitrates could ever be obtained from either of the bottles. The experiments of Warington show that these trials were vitiated by the strong light to which the bottles were exposed. It is not altogether unlikely that different results would have been reached if the bottles had been kept in the dark.

oxide, of black oxide of manganese, or of gypsum. I can say with Millon,* that, in spite of all that has been written in favour of the oxidation of ammonium by ferric oxide, "I owe it to truth to state that though the most varied attempts have been made to oxidise ammonia in the cold (*i.e.*, in the wet way), by peroxide of iron, they have all proved unavailing."

I am indebted to my assistant, Mr. D. S. Lewis, for his careful attention to the details of these experiments."

Bussey Institution, Jamaica Plain, Mass., April, 1878.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, June 20, 1878.

Dr. J. H. Gladstone, F.R.S., President, in the Chair.

The minutes of the preceding meeting were read and confirmed. The following gentlemen were duly elected Fellows of the Society:—E. R. Budden, C. T. Macadam, W. R. Criper.

The eleven following papers were read:—

"*Contributions to the History of the Naphthalene Series (No. II. β-Naphthaquinon)*, by J. Stenhouse and C. E. Groves. In a previous paper the authors mentioned that nitroso-β-naphthol, when converted into the corresponding amido-naphthol and then submitted to oxidation, yielded a crystalline compound of the nature of a quinon; this substance was named β-naphthaquinon. The authors have obtained, by acting on this body, in a state of purity, with nitric acid sp. gr. 1·2, red crystals melting at 158°. This crystalline substance has the composition—

$$C_{10}H_5(NO_2)O_2,$$

mono-nitro-β-naphthaquinon; it is reduced by hydriodic or sulphurous acid, forming two new substances, probably the corresponding nitro-hydroquinon and the amido-hydroquinon. By treating β-naphthaquinon with dilute sulphuric acid a dark coloured compound was obtained, which, on reduction, yielded white acicular crystals, and on oxidation orange-coloured prisms, the three substances evidently standing in the same relations to one another as green quinhydron, quinol or hydroquinon, and quinon in the benzene series. The new quinon has the formula $C_{20}H_{10}O_4$, which the authors substantiated by analysis and quantitative experiment; it is very stable. The hydroquinon obtained by reducing the quinon forms colourless needles, oxidising with comparative ease, and becoming dark coloured on exposure to the air. Its formula is $C_{20}H_{10}(OH)_4$, and it may be regarded as a tetrahydric alcohol of the hydroquinon or quinol species, derived from a dinaphthyl, $C_{10}H_7C_{10}H_7$, by the displacement of four hydrogen atoms and four OH groups, and is a member of a new class of bodies, the diquinols. The authors propose to call it dinaphthyl-diquinol, and its quinon dinaphthyl-diquinon. Benzoquinon and α-naphthaquinon also yield diquinons and diquinols, which the authors are studying.

"*On Pyrotritaric and Carbo-pyrotritaric Acids*," by G. Harrow. The author has saponified diaceto-succinic ether with dilute sulphuric acid; he obtained a crystalline substance mixed with an oil. The oil was separated by distillation and dried; it boiled at 208° to 209°, had the formula $C_9H_{12}O_3$, and was decomposed by dilute soda into alcohol and an acid, $C_7H_8O_3$, melting at 135°. This acid proved to be the pyrotritartaric acid of Wislicenus and Stadincki (uvic acid of Böttinger). The silver and sodium salts were prepared and studied. The crystalline substance consisted of an acid, melting at 230°, crystallising from hot water in long needles, and having the formula $C_8H_8O_5$, and an ether of this acid crystallising in silky plates, which melt at 81° to 82°. The monobasic and dibasic silver and sodium salts of this acid were prepared. It proved to be carbo-uvic or carbo-pyrotritaric acid. On heating dry carbo-uvic acid, CO_2 was evolved, uvic acid being left. The reactions which occur on saponifying diaceto-succinic acid are then—

(1) $C_{12}H_{18}O_6 + H_2O = C_8H_8O_5 + 2C_2H_5HO$,

(2) $C_{12}H_{18}O_6 + H_2O = C_9H_{12}O_3 + CO_2 + C_2H_5HO + H_2O$.

In conclusion the author discusses the constitution of carbo-uvic and uvic acids.

"*On the Action of Alkaline Hypobromite on Ammonium Salts, Urea, and Oxamide*," by W. Foster. In the first part of the paper the author gives a *resumé* of our knowledge as to the action of hypobromite on ammonium salts and urea, detailing some experiments of his own which, in the main, confirm the results of previous observers, the reactions varying to a certain extent with the strength of the hypobromite solution. He then proceeds to investigate the action of alkaline hypobromite on oxamide; as a mean result he finds that oxamide gives off 74·87 per cent of its total nitrogen when it is acted on by the ordinary hypobromite solution. He then endeavoured to ascertain the precise condition of the suppressed nitrogen, but without complete success. The experimental evidence is in favour of the nitrogen remaining a nitrate, whilst general considerations point to the formation of cyanate. The author suggests as the formula of oxamide—

$$C_4\begin{cases}(NH)_3\\NHHO\\(HO)_3\end{cases}$$

"*Action of the Halogens at High Temperatures on Metallic Oxides*," by C. F. Cross and S. Suguira. The authors have investigated the action of the halogens on lead oxides by heating these bodies (1) in a mixture of the halogen and air, and (2) in the pure halogen. The products with bromine and chlorine were mostly liquid at the temperature employed; with iodine heavy infusible powders were formed. The authors draw attention to the constancy of the percentage of residual oxygen in the product of each series of reactions, thus:—

	Pure Halogen. P. c. of Residual Oxygen.	Halogen and Air. Per cent.	Ratio.
I compounds ..	4·12	5·63	1 : 1·3
Br ,, ..	1·43	2·14	1 : 1·5
Cl ,, ..	0·76	1·25	1 : 1·8

The action of iodine in the presence of oxygen upon oxides and carbonates of the alkaline earth metals is interesting, as, instead of (as with lead) oxyiodides being formed, periodates are produced; thus, calcium and barium periodates were obtained. In the absence of oxygen this fixation of iodine by the alkaline earths does not take place.

"*On Manganese Tetrachloride*," by W. W. Fisher. The author has studied the chlorides formed when the binoxide of manganese is dissolved in strong hydrochloric acid at the ordinary temperature; also the action of hydrochloric acid on red oxide of manganese. The results point to the conclusion that the oxides of manganese, higher in degree than the protoxide, when treated with an excess of strong hydrochloric acid, give brown liquids containing a highly chlorinated manganese compound, probably $MnCl_4$, which is readily resolved into manganous chloride and free chlorine, and that on dilution with water hydrated manganese binoxide is precipitated in each instance. Since a large of excess of hydrochloric acid or alkaline chlorides seem to render $MnCl_4$ more stable, it is probable that this body only exists in a combination analogous to chloroplatinic acid.

"*On Salts of Nitrous Oxide*," by A. E. Menke. The author has prepared the sodium salt of nitrous oxide

* Chem. News, 1860, ii., 337, from *Comptes Rendus*.

by fusing nitrate of soda with iron filings. Zinc was substituted for iron, but the salt was not formed. The sodium salt is very soluble in water, and crystallises in white needles; it has the composition $NaNO,3H_2O$. The silver salt previously obtained by Divers was prepared, and its composition confirmed. Details of the preparation and the reactions of the sodium salt are given.

"*Notes on Madder Colouring Matters*," by E. SCHUNCK and H. RŒMER. The authors have prepared some quantity of munjistin from 100 lbs. of munjeet. In order to remove any doubt as to the identity of the colouring matter obtained from commercial purpurin with munjistin they have examined the latter substance with great care. It was obtained in golden yellow scales, melting at 231° C.; it had the same properties and composition as purpuroxanthic acid. Acetic anhydride forms, when boiled with munjistin, an unstable compound, melting at about 160°. Bromine forms orange-yellow needles, melting at 231°; its composition was that of dibrom-purpuroxanthin, the carboxyl group having been eliminated. Boiling potash forms with munjistin purpurin, and ammonia converts it into purpurinamide. By the action of fuming nitric acid orange coloured needles, melting at 251°, very similar to but readily distinguished by their behaviour to ammonium acetate from dinitro-purpuroxanthin.

"*On the Occlusion of Hydrogen by Copper*," by G. S. JOHNSON. The author has made an elaborate series of experiments to determine the causes of the discrepant results obtained by previous experimenters—Graham, Thudichum, &c. The principal facts established are the following:—When metallic copper is repeatedly oxidised and reduced by hydrogen in the same tube, progressively decreasing quantities of hydrogen are occluded. Thus, 37 grms. of copper wire gave, at first, 0·010 grm. water; finally, 0·004, until a constant minimum is reached. The variation in the quantity occluded does not depend altogether on the physical condition of the surface of the metal. At a red heat copper oxide occludes carbonic anhydride, and will not part with that gas in air at the temperature of occlusion or when reduced at a red heat by hydrogen. By fusion of the oxide the carbonic anhydride is evolved. In conclusion the author states that the discrepancy between the results obtained by different experimenters is explained (1) by the fact that hydrogenised copper retains nearly all its hydrogen *in vacuo* at a red heat; (2) that the same metal occludes varying quantities of hydrogen under different conditions. The amount occluded is, however, in most cases sufficient to introduce a serious error in organic analysis. The author recommends the plan of Dr. Thudichum for obviating this error, viz., ignition of the reduced metal in CO_2 for some time before use. The pure spongy metal reduced from precipitated oxide might be substituted for commercial copper.

"*On the Rôle Played by Carbon in Reducing the Sulphates of the Alkalies*," by J. MACTEAR. In 1839 Liebig suggested a process for the manufacture of carbonates founded on a discovery of Gay-Lussac, that caustic potash heated with sawdust evolves pure hydrogen, potassic oxalate and acetate being formed; by heating to redness these two salts are converted into carbonates. Liebig substituted sodium sulphide for caustic potash, and found that a similar reaction took place. The process, however, failed commercially. The author has investigated in detail the action of various quantities of carbon on the alkaline sulphates at various temperatures. When sulphate of soda is mixed with an excess of carbon and exposed to a temperature considerably above red heat out of contact with air, the reaction is—

$$Na_2SO_4+4C=Na_2S+4CO.$$

When a temperature of dull redness, 1150° to 1300° F., is used the action is—

$$3Na_2SO_4+6C=Na_2CO_3+Na_2S_2+Na_2S+4CO_2+CO.$$

The decomposition of sulphate of potash is similar but takes place at a lower temperature.

"*On the Action of Ethyl-chlor-carbonate on some Oxygenated Haloid Compounds of the Fatty Series*," by O'NEILL F. KELLY. Some years ago Wurtz effected the synthesis of several aromatic monobasic acids by submitting a mixture of a monochlor or monobrominated hydrocarbon and ethyl-chlor-carbonate to the action of sodium amalgam, $CO.OC_2H_5$ being substituted for the haloid element. The author endeavoured to effect this substitution in di- and tri-substituted haloid hydrocarbons in the fatty series with the following results:—55 grms. of ethyl-chlor-carbonate and 54 grms. of allyl-alcohol dibromide were heated with 2·4 kilos. of sodium amalgam for five hours in a flask, to which a reversed condenser was attached. The evolved gases, after passing through bromine, were collected over water, and found to consist at first of CO and CO_2, but finally of CO_2. Ethyl-carbonate, propylene, dibromide, and a trace of allyl-alcohol were the products of this reaction. Glycerin, dichlorhydrin, and ethyl-chlor-carbonate were the next substances experimented with. After heating twelve hours with sodium amalgam, the flask was cooled and water added, and the oil which separated washed and dried. On distillation one-third came over between 100° to 190°, and consisted of—

$$CO\begin{cases}Cl\\OC_2H_5\end{cases}$$

$CO(OC_2H_5)_2$, and $C_3H_5OHCl_2$. The portion which came over between 190° and 240°, after repeated fractionation, boiled at 225° to 230°; it consisted of $C_6H_{10}Cl_2O_3$. Some $C_2H_4Br_2$ was also obtained. No allyl-alcohol was formed. The author has confirmed the results of Hübner and Müller, that dichlorhydrin is converted by sodium amalgam at 100° C. into allyl-alcohol. Epichlorhydrin and ethyl-chlor-carbonate.—These substances when heated with sodium amalgam yielded $CO(OC_2H_5)_2$, boiling at 126°, and a mobile liquid with a bitter pungent taste, boiling at 145° to 150°, having the composition $C_6H_{10}O_3$, and yielding on saponification allyl-alcohol.

"*Laboratory Notes*," by H. E. ARMSTRONG.

The Society then adjourned over the recess.

PHYSICAL SOCIETY.

June 22, 1878.

Professor G. C. FOSTER, Vice-President, and afterwards Prof. W. G. ADAMS, President, in the Chair.

THE following candidate was elected a member of the Society:—Mr. F. W. Grierson.

Prof. W. G. ADAMS exhibited a new form of Polariscope, suitable for projecting on to a screen the figures formed by any crystal, and for measuring the angle between the optic axes. Parallel light from the electric lamp, after traversing a Nicol of about 2 inches aperture, is rendered divergent by a set of lenses. The crystal under examination is placed in a recess formed by removing a slice from the middle of a spherical lens, which is capable of motion in any direction about its centre, while any movement in the vertical plane passing through the axis of the instrument can be measured by a scale and vernier; and if, by such a motion, the point on the screen representing the position of one axis, when the two are in the vertical plane, be transferred to that indicating the position initially occupied by the other axis, we have at once a measure of the optic angle of the crystal, for the rotation of two plano-spherical lenses forming an exact sphere has no effect on the direction of the beam.

Mr. WALTER BAILY read a paper "*On the Effect of Starch, Salicène, Unannealed Glass, &c., on Polarised Light.*" In his experiments light was passed through a

Nicol prism, then through a quarter undulation plate, and then through a body having an optical structure symmetrical round an axis in the direction of the ray, such as any of the above-named substances. The axes of the quarter undulation plate being taken as axes of reference, ρ being the angle between the plane of polarisation and one of these axes, σ half the difference of retardation at a given point between the part of the light resolved in a plane through the axis of the body and the part resolved perpendicular to that plane, ϕ being the angle between an axis of the quarter undulation plate and the perpendicular on the axis of the body from the given point (which perpendicular is taken as the initial line in the equation to the ellipse defining the light at such point) and $r\,\theta$ being the co-ordinates of this ellipse, the writer finds the equation to the ellipse to be—

$$1+A\cos 2\theta+B\sin 2\theta=r^{-2}[1-(A^2+B^2)],$$

where $A=-\cos 2\rho\cos 2\phi$ and—

$$B=\sin 2\rho\sin 2\sigma+\cos 2\rho\cos 2\sigma\sin 2\phi.$$

From this equation diagrams have been drawn to exhibit the condition of the light at every point for different positions of the polariser. For the simple case of salicene or starch, in which the difference of retardation is the same, or nearly so, for all distances from the axis of the body, the diagram consists of a ring of ellipses of various eccentricities and inclinations, each ellipse showing the condition of the light along the radius on which it lies. For the general case, in which the difference of retardation is a function of the distance from the axis of the body, the diagram consists of two series of curves, one series being "isomorphal" curves, or curves along which the eccentricity of the ellipse is constant, and the other series being "isoclinal," or curves along which the inclination of the axis major of the ellipse to the perpendicular in the axis of the body is constant. The general equation to the isomorphal lines is $A^2+B^2=$ constant, and to the isoclinal lines—

$$\frac{A}{B}=\text{constant}.$$

These two series of curves completely define the form and position of the ellipse of polarisation at every point, and render it easy to determine what appearances will be presented on passing the light through an analysing prism in any given position. The results obtained were illustrated by some experiments.

Prof. W. C. UNWIN made a communication on the flow from orifices at different temperatures. A paper recently appeared in the *Franklin Journal of Science* by Mr. Isherwood, giving results of experiments on this subject, and, according to him, the volume discharged from a given orifice is increased by about 12 per cent on raising the temperature from 60° F. to 212° F. It is difficult to accept this result, because the friction is known to diminish the discharge by an amount much less than 12 per cent, and no other cause than decrease of friction can be assigned to account for Mr. Isherwood's results. In the author's experiments the increase of discharge at 190° above that at 60° was only 4 per cent, with conoidal orifices in the form of the *vena contracta*. With thin-edged orifices the variation of discharge was still less. He is disposed to think that the great increase of discharge in Mr. Isherwood's experiments was due to diminution of friction in a rather small pipe leading to the orifices, and would not occur with any other arrangement.

Mr. GORHAM then read a paper "*On Complementary Colours*." He stated that the three primaries are green, red, and blue, and not yellow, red, and blue; that yellow is a binary compound of green and red; and that yellow and blue when mixed form white. He remarked that after looking at a green disc the eye evokes another colour, but this is not seen unless certain conditions are fulfilled; thus the undulations must be arrested by a gray surface. This was proved by an experiment, in which a green disc carrying a concentric ring, half white and half black, was caused to rotate, when a medium grey was produced, and this at once arrested and made visible pink, the complement of the green. Several other complementaries were shown by the same means. Mr. Gorham next showed how the greys can be formed by cancelling either reflected or transmitted rays of white light. The first of these cases is illustrated by white paper painted over with a wash of Indian ink, and the second by the well-known Berlin tiles, in which light and shade are obtained by giving varying thickness to the ware. He showed that this last effect may be imitated by piling strips of paper to varying heights, and he has succeeded in photographing geometrical figures so formed. Lastly, the author explained a method of arresting and showing the complementaries more satisfactorily than he considers has hitherto been done. Six thicknesses of white paper are gummed together and cut into a ring, a ring of the same size and shape being also cut from a disc of coloured paper, and the white ring is let in to fill its place. On observing such a disc by white transmitted light the complement is seen through the ring.

Prof. S. P. THOMPSON exhibited a series of magnetic figures illustrating electrodynamic relations. The lines of magnetic force around a wire carrying a magnetic current can be shown by passing a wire through a glass plate, strewing iron filings around, and tapping the plate gently. The filings may be fixed in their places, if the plate has previously been gummed and dried, by softening the gum with steam. Such a prepared plate may be used to project the figures of the magnetic curves in the lantern. Two parallel like currents attract, their curves forming a figure illustrative of the action; or they repel if travelling in opposite directions, the repulsion also being evident from the form of the curves. It was shown by a series of such lantern slides that a very large number of electrodynamic relations can be illustrated by curves produced in this manner. Figures were thrown upon the screen illustrating the law of oblique currents, the attraction of a magnet into or its repulsion out of a circuit, the deflection of a magnetic needle by a current, and the mutual tendency of a current and magnetic pole to rotate. A very curious figure was produced by a current running through a magnet longitudinally. A transverse section of the lines of force at a pole gave neither the radial lines of the magnet nor the circular lines of the current, but a series of spirals. It was argued that Faraday's conception of the lines of force tending to shorten themselves supplied the means of interpreting the physical effects indicated by the lines of force in the various figures.

The SECRETARY read a paper by Mr. C. H. HINTON "*On the Co-ordination of Space*." If a cubical space be divided into 27 numbered cubes, and each of these be again subdivided in the same way, and so on, the position of any point within the initial cube can be expressed by a reference to the numbers of the several cubes in which it is placed, and the more this series of numbers is extended, the more accurately is its position defined. And further, if we consider an expression of the form—

$$\ldots:.rqponm.lkjih\ldots:\ldots$$

where each letter stands for any number from 1 to 27, and if m, before the dot, indicates the unit space, it will be evident that by such an expression the position of any point in space can be indicated with any degree of accuracy, each letter representing a space 27 times as great as that which immediately succeeds it; or, in place of 27, any other number offering special facilities for a given purpose may be employed. The author then gives some account of the manner in which the system can be utilised for classifying chemical phenomena and in arranging plants, &c.

An adaptation of the telephone and microphone for communicating vibrations to the phoneidoscope by Mr. TISLEY was then shown. The metal disc carrying the soap-film is fixed just above the telephone plate, and, this being in circuit with a microphone and battery, any vibra-

tion imparted to the microphone at once sets the soap-film in action, the characteristic figures being at once obtained.

Mr. A. Haddon exhibited a modified form of microphone which he has arranged with a view to make the same instrument available for receiving sounds of any given intensity. Its main peculiarity consists in having a thin strip of elastic attached to the middle of the pointed graphite. By varying the tension of this elastic the sensitiveness of the instrument can be accurately regulated.

The meeting of the Society was then adjourned until November.

CORRESPONDENCE.

SUGAR TESTS.

To the Editor of the Chemical News.

Sir,—The question about the absorption or non-absorption of sugar by bone-black having again arisen, and very considerable and persistent discrepancies having occurred in sugar tests by polarisation which can hardly be explained except by reference to the char, I have taken pains to collate such books as I happen to have in my office, and which bear upon the subject, with the following results, viz.:—

Dr. J. J. Pohl ("Anleitung zum Gebrauct des Mitscherlich'schen Polarizations Saccharimeters." Wien, 1858), gives the following directions for preparing solutions for polarisation, viz.:—"Coloured solutions must be decolourised (cleared), and for this purpose acetate of lead and animal charcoal are serviceable. [I omit the preparation and use of the lead solution, as there is no contested principle involved.] As a cool filter we use a glass tube 200 millimetres long and 20 m.m. internal diameter, contracted at the bottom, held fast in a vertical support, and having in its lower part a loose plug of cotton. Animal charcoal [no specific directions about burning or drying this are given], to the amount of 25 c.c., is put directly into the filtering-tube, and the fluid to be filtered is poured thereon. The first 30 to 35 c.c. that run off are weaker [in sugar, verdünnter] than the later filtrate, and the second part of the filtrate is used for determining in the saccharimeter the rotatory power of the solution."

In Mandelblüh's useful book ("Seiffaden zur Untersuchung der Verschiedenen Zuckerarten, &c." Brünn, 1867), we find the following directions, viz.:—After describing the use of lead, the author goes on to say that if the solution is steel-coloured filtration over charcoal is needed. "As a char-filter we use a glass tube 200 m.m. long and 20 m.m. wide, contracted at the bottom. In the contracted part is a plug of cotton, and upon this 25 to 30 c.c. of fine bone-char. Upon this the solution is poured. The first 30 to 40 c.c. are rejected, since these are weaker [in sugar, verdünnter] through the absorption by the char, and the second part of the filtrate is employed for investigation."

In "Saccharimetrie Optique, Chimique, &c." (par M. L'Abbé Moigno: Paris, 1869), we find the following:—After having directed that 49·50 grms. of molasses shall have been dissolved in 300 c.c. of water, the author goes on to say—"Animal charcoal in fine grains, to the amount of 80 c.c., is spread upon a filter, and all the solution is turned upon this filter. [This must be a gross error if the char takes up sugar, for *all* the solution is exposed to the action of the char, instead of reserving a portion.—J. M. M.] When an amount of solution about equal in bulk to the char has run through, the receiving-vessel is changed, and only the remainder of the filtrate is preserved. This is poured *ten or twelve times* [the italics are mine.—J. M. M.] over the char in order that it may be decolourised as thoroughly as possible." The author appears to use no lead solution.

Weiss ("Beitrage zur Quantitativen Bestimmung des Zuckers, &c.," 1874; and Wild, "Uber ein neues Polaristrobometer, &c.," 1865) discuss optical problems only, and I believe say nothing about the preparation of solutions. The same is in a measure true of Gautier's and Violette's treatises.

Emile Monier ("Guide pour l'essai et L'Analyse des Sucres." Paris. No date subsequent to 1864), speaking of the decolourising of molasses solutions for polarisation, says—"As the subacetate of lead does not completely decolourise the molasses, we re-filter the solution over perfectly dry bone-black."

Coming now to a more recent work ("Anleitung zur Untersuchung der für die Zucker Industrie in betract kommenden Rohmaterialen, &c." Von Dr. R. Fruhling und Dr. J. Schulz. Braunschweig, 1876), we find the following directions:—Assuming that acetate of lead does not sufficiently clear the solution, the authors says—"For such cases should be kept ready a pulverised and dry bone-char, whose action in respect to the absorption of sugar has been exactly determined by previous experiments. For 30 c.c. of the coloured filtrate [from the lead] 3 or 4 grms. of such cool are taken, put into a dry flask with the filtrate, shaken thoroughly, and filtered through a small dry filter." The authors then give directions to add to the result obtained by polarisation the coefficient of absorption of the cool, found by previous experiment. This seems to me a process at once exceedingly clumsy, and likely to introduce error. How much simpler and safer it is to adopt the method laid down in the earlier books, and used by myself in several thousands of tests, viz., to allow the first half or third of the solution to run away before taking a sample to test.

Direct experiments made by myself and my assistant, using both pure and commercial sugars, and employing a Soleil-Duboscq polariser and a Ventzke instrument of great delicacy, convince me that, with *well dried char*, the error introduced into the analysis, by neglect of the simple and well-grounded precaution of throwing away the first runnings, may amount to 1·4 per cent; an error wholly inexcusable.

Besides the books I have quoted the following papers may be consulted:—"Sostman Zucker bestimmung in gebrauchter Knochenkohle," *Zeitschrift fur Zucker-Industrie*, 1872, p. 259. "Rapport sur le Concours relatif a la Saccharimetrie, &c.," *Bulletin de la Société Encouragement*, April, 1848.

I propose to give my analytical results in a future note.—I am, &c.,

J. M. Merrick.

59, Broad Street, Boston, U.S.A.,
June 8, 1878.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Note.—All degrees of temperature are Centigrade, unless otherwise expressed.

Comptes Rendus Hebdomadaires des Séances, de l'Académie des Sciences. No. 20, May 20, 1878.

Part Played by Auxiliary Acids in Etherification. M. Berthelot.—The author remarks that Thenard and Scheele remarked that certain mineral acids, especially sulphuric and hydrochloric, have the property of determining the immediate combination of alcohol with the organic acids, such as the acetic, benzoic, &c. He has examined the conditions of the acceleration, the limits of etherification, and the distribution of the alcoho between the two acids.

Application of the Telephone on Board the "Desaix."—M. Trève.—By means of the telephone the *Desaix* has been able to communicate with her consort the *Argonaute*. The telephone has also been successfully used in diving operations, allowing the divers to report what they find or do without being obliged to ascend as was formerly necessary.

Alloys of Gallium and Aluminium.—Lecoq de Boisbaudran.—The author has prepared alloys of gallium with several metals, and has more particularly studied those of gallium and aluminium. If the proportion of the latter is to be considerable the two metals are heated together up to dull redness. The alloys thus obtained remain brilliant and do not sensibly absorb the oxygen of the atmosphere during their preparation. After cooling they are solid, but brittle, even when the excess of aluminium has raised the melting-point up to incipient redness. They decompose water when cold, but better at 40°, with rise of temperature, escape of hydrogen, and formation of a chocolate-brown powder, which is ultimately resolved into white flakes of alumina; almost the whole of the gallium is liberated in the form of globules, which appear quite free from aluminium. These alloys generally decompose water like an amalgam containing a medium proportion of sodium, but in certain cases the reaction is as brisk as with sodium itself. The escape of hydrogen caused by a solid alloy is considerably augmented by the contact of a globule of liquid gallium. A galvanic element is evidently formed of which the aluminium is the oxidisable metal. Superfused gallium dissolves aluminum even below 15°, forming very brilliant liquid or pastey alloys, not easily attacked by the air, but decomposing water very readily. As regards its alloys gallium seems to possess properties in common with mercury and lead.

Production of Liquid and Gaseous Hydrocarbons by the Action of Pure Water upon a Carburetted Alloy of Iron and Manganese.—S. Cloez.—Water alone acting when hot upon a carburetted alloy of iron and manganese yields its oxygen to the metals, forming at first protoxides, which pass ultimately, by the action of the air, to a higher stage of oxidation. Part of the hydrogen escapes in a free state, whilst the rest combines with the carbon to produce hydrocarbides analogous to those found in the earth, and known as petroleum.

On an Induction Machine.—M. Gaiffe.—A modification of the arrangement of the electro-magnet adopted by M. Siemens.

Detection of Ozone in the Atmosphere.—Albert Levy.—The author maintains that the ozonoscopic paper may be safely used when exact determinations are not required.

On an Allotropic Modification of Copper.—P. Schützenberger.—The modification in question is obtained by the electrolysis of certain cupreous solutions. It is less red than ordinary copper, brittle, absolutely devoid of malleability, and of the specific gravity 8·0 to 8·2. If washed with water and exposed to the air it is oxidised with great rapidity. Pure nitric acid diluted with ten parts of water attacks it very strongly, with the escape of protoxide of nitrogen almost pure, the metal becoming covered with a blackish olive layer. Ordinary copper is scarcely attacked at all by so weak an acid; with a stronger acid it evolves nitric oxide. Heat, or the prolonged action of dilute sulphuric acid, converts this abnormal metal into ordinary copper.

On "Pelletierin," an Alkaloid from the Bark of the Pomegranate Tree.—M. Tanret.—This alkaloid is volatile and powerfully basic, forming well-defined salts. It precipitates the chlorides of palladium and of gold, but not that of platinum. It gives a white precipitate with the salts of lead, mercury, zinc. and silver, the two last being soluble in an excess of pelletierin. Its composition has not been determined. (We cannot approve of M. Tanret's new principle of chemical nomenclature.)

On a New Synthetic Method for the Formation of the Carbides of Hydrogen.—Fr. Landolph.—The fluoboric compounds of the carbides of hydrogen, such as fluoborethylen, easily react upon oxygenated organic compounds capable of yielding carbides of dehydration. The powerful affinity of boron for the elements of water sets up these reactions, and enables us thus to obtain synthetically a great number of the carbides of hydrogen.

Berichte der Deutschen Chemischen Gesellschaft, No. 4, 1878.

Further Communications on Ornithuric Acid and its Derivatives.—M. Jaffé.—An examination of the ornithurates of lime and baryta, and of a base which the author names ornithin.

Difference in the Attraction of Caustic Soda and Chloride of Calcium for Water.—W. Müller-Erzbach.—The attraction of caustic potassa for water is intermediate between those of caustic soda and of chloride of calcium.

No. 5, 1878.

Molecular Constitution of Vapours, in Reply to Horstmann's Criticisms.—Alex. Naumann.—The writer points out that Horstmann has confounded molecular weight with vapour density.

Comparison of ε-Purpurin with Purpuroxanthincarbonic Acid, and on Anthraflavon.—E. Schunck and H. Römer.—The authors, in opposition to H. Rosenstiehl, regard ε-purpurin not as a chemical individual, but as a mere mixture, and consider that his α-anthraflavon must be meta-benz-bioxy-anthraquinon.

Determination of Nitrous and Nitric Acids.—G. Lunge.—This paper cannot be fairly abstracted without the accompanying engraving. The author criticises the process described by Mr. Davis (CHEMICAL NEWS, xxxvii., 45). He maintains that without the correction for temperature and barometric pressure an error of 10 per cent would frequently occur at Zürich, and complains that Mr. Davis has not given in proof of the accuracy of the method the analysis of any pure substances, or of such as had been mixed with known quantities of impurites.

Chemical Examination of the Water of the Danube at Buda Pest.—M. Ballo.—The author observes that the amount of suspended matter is directly proportionate to the height of the river, whilst the dissolved substances vary in the inverse proportion. One litre, taken in the middle of November, 1872, contained:—

Calcium bicarbonate	0·1277
Magnesium „	0·0633
Calcium sulphate	0·0292
Sodium chloride	0·0035
Ferric oxide	traces
Silicic acid	0·0018
Free carbonic acid	0·0163

"besides ammoniacal salts, nitrates, and organic matter," the quantity of which is not given.

Behaviour of Tetra-chlor-ether and Acetyl-chloral-alcoholate with Potassium Cyanide and Alcoholic Potassa.—J. Busch.—The action of potassium cyanide upon tetra-chlor-ether is feeble. The quantity of ether employed is almost entirely recovered unchanged, whilst the residual liquid smells strongly of isonitril. The reaction of alcoholic potassa is more effective. An unsaturated ether is obtained, which, under water and in closed vessels, remains almost unchanged, whilst in the air it takes a pungent odour, though its boiling-point (154° to 156°) remains unaltered. Treatment with hydrochloric acid gas does not reconvert it into tetra-chor-ether.

Products of the Dry Distillation of Calcium Pimarate.—G. Bruylants.—The author has obtained by the dry distillation of this salt, not merely the following

products belonging to the fatty series, ethylen, propylen, amylen, ordinary aceton, methyl-ethyl-keton, and diethyl-keton, but also hydrocarbons of the aromatic series, such as toluol, dimethyl-benzol, methyl-ethyl-benzol, and hydrocarbons of the camphoric groups, such as tereben and ditereben.

Connection of the Chemical Compounds in Volatile Oils.—G. Bruylants.—The author undertakes to show that a relation exists between the component parts of one and the same oil. We may in general assume that the hydrocarbon is the original chemical individual from which alcohols, aldehyds, acids, &c., are derived by processes of hydratation, oxidation, or reduction, perhaps during the life of the plant. The author gives the results of his researches on the oils of valerian and of tansey.

On Pyroxanthin.—H. B. Hill.—Pyroxanthin, after recrystallisation from alcohol, forms fine, shining, orange-yellow needles, with a bluish reflection. From a solution in boiling benzol it is obtained in large reddish yellow monoclinar prisms. Its composition may be represented by the formula $C_{15}H_{12}O_3$. If boiled with zinc-powder and glacial acetic acid diluted with a little alcohol it forms a colourless solution, from which water precipitates a white voluminous substance, probably hydro-pyroxanthin.

On Borneo Camphor.—J. Kachler.—The author is engaged with a comparative examination of the natural Borneo camphor of *Dryobalanops Camphora*, and of the borneol obtained by Baubigny's method from the camphor of the Laurineæ. He finds that both borneols yield with phosphorus pentachloride or with strong hydrochloric acid identical chlorides, $C_{10}H_{17}Cl$, which melt at 147° to 148°. This chloride is readily decomposed if heated in tubes to 100° along with water, yielding hydrochloric acid and a solid camphin, $C_{10}H_{16}$, which melts at 51° to 52°, and boils about 160°.

A New Indicator in Alkalimetry.—W. v. Miller.—The indicator proposed is tropeolin, a new colouring-matter discovered by O. Witt, and manufactured by Messrs. Williams, Thomas and Dower. The shade known as 00 is characterised by its behaviour with concentrated sulphuric acid, which turns its aqueous solution from a yellow to a crimson red. According to the author this reaction is common to all the mineral acids, even dilute, and to certain organic acids, especially the oxalic. Hence this variety of tropeolin is a valuable indicator in alkalimetrical titration, as has been proved by a series of comparative experiments with this colour and with litmus. The alkaline liquid to be titrated is mixed with an aqueous solution of tropeolin containing 0·05 per cent of the colour, so that 2 c.c. of tropeolin solution are added to 50 c.c. of the liquid to be analysed, and the acid is dropped in till the light yellow colour of the solution changes suddenly to a yellowish red. The point cannot be overlooked, for the transformation of colour is too striking, and the addition of a further drop removes all doubt by converting the orange colour into a decided red. Tropeolin can be preserved either in the dry or the wet state, and has the decided advantage that it is not affected either by acid carbonates or free carbonic acid. Hence the alkaline carbonates can be titrated without the aid of heat. If tropeolin is used as an indicator a normal solution of sodium carbonate may be used instead of one of a caustic alkali, which is difficult to preserve. Further, tincture of litmus is reddened not merely by free acids, but by neutral metallic salts, whilst the yellow solution of tropeolin is turned red only by free acids, solutions of metallic salts having no effect.

Oxidation of Xylol-sulphosamids (Third communication).—W. Iles and Ira Remsen.—An examination of oxytoluylic acid and its salts.

Compound Obtained by the Interaction of Aceton, CyK, CySK, H_2O, and Aqueous Hydrochloric Acid.—F. Urech.—The compound in question, $C_5H_7NO_2S$, forms snow-white crystals, which melt at 152°. If heated to 120° along with concentrated hydrochloric acid under pressure it is resolved into carbonic acid, sulphuretted hydrogen, acetonic acid, and sal-ammoniac.

Formulæ of the Xylol-sulphamids.—Ira Remsen.—A hypothetical paper.

Nitro-derivatives of the Hydroquinons.—R. Nietzki.—The author, on treating an acetylised hydroquinon with nitric acid, obtained a nitro-derivative, which crystallises from alcohol in fine sulphur-yellow needles, melting at 96°, and which on treatment with cold dilute caustic alkali yields a splendid violet-blue liquid, turning to a golden-yellow on the addition of acids.

Synthesis of the Aromatic Sulphones from the Chlor-anhydrides of Sulphonic Acids and Hydrocarbons by the Action of Aluminium Chloride.—H. Beckurts and R. Otto (Preliminary notice).—The authors find that the process of MM. Friedel and Crafts is well adapted to effect the synthesis of sulphones.

On Aurin.—E. and O. Fischer.—Leucanilin prepared from pure aurin, on the decomposition of its diazo-compound by the addition of alcohol, yielded a crude hydrocarbon, from which the authors have succeeded in obtaining pure triphenyl-methan.

On Invertin.—M. Barth.—The author has isolated and analysed this ferment, which he finds composed of—

Carbon	43·9
Hydrogen	8·4
Nitrogen	6·0
Sulphur	0·63
Oxygen	41·17
	100·10

He has also compared its action with that of other ferments and finds that it is slower and more feeble than many especially emulsin.

On Atmospheric Hydrogen Peroxide.—E. Schœne. (Second communication).—The author concludes that when the barometric minimum, which affected the state of the weather in Moscow, lay to the north of that city the rain and snow contained on an average more hydrogen peroxide than when such minimum lay to the south.

Sulphin Compounds of Thio-urea.—A. Bernthsen and H. Klinger.—The authors, from the result of the reaction between certain thio-urea compounds and mercuric oxide, consider it probable that the constitution of these addition-products resembles that of the sulphin bases.

Potassium Cyanide and Dibromo-succinic Ether.—A. Claus and Fr. Calliess.—The final product was succinic acid. The authors did not succeed in isolating dicyano-succinic acid.

Potassium Cyanide and Dichloracetic Ether.—A. Claus and R. Weiss.—The results are decidedly opposed to the formation of a dicyanacetic acid.

Formation of Dichloracetic Ether from Chloral.—A Claus.—An inquiry into the conditions under which cyanogen can be introduced into organic compounds.

Occurrence of Allantoin and Hippuric Acid in the Urine of Dogs.—E. Salkowski.—The author finds the urine of dogs, under normal circumstances, free from allantoin. Hippuric acid was observed in the urine of dogs confined entirely to a flesh-diet, though the maximum amount did not exceed $\frac{1}{125}$ of the urea secreted.

Action of Phosphorus Penta-sulphide upon Amides.—A. Bernthsen.—The reaction of phosphorus penta-sulphide with amides affords a new process for the preparation of thiamides.

Remarks on the Previous Paper.—A. W. Hofmann.—A personal communication.

Moniteur Scientifique Quesneville.
May, 1878.

Carbonisation of Vegetable Matter mixed among Wool by means of Aluminium Chloride.—This process, invented some years ago by M. Joly, of Elbeuf, is decidedly superior to those in which free acids are employed, as the colours are not attacked, and there is no fear of stains. The wool is impregnated with a solution of aluminic chloride at 6° or 7° Baumé, drained in a centrifugal, and dried in a stove at 100° to 125°. It is afterwards washed to remove the chloride.—*Deutsche Woltengewerbe.*

Cerulein and Gallein.—These two dyes are at present manufactured on the large scale at Bâle. According to M. H. Kœchlin, gallein yields, in printing, rose and violet shades which resist soap very well. With a chrome mordant fuller shades are obtained, and with salts of iron a pleasing grey. Cerulein dyes olive shades with mordants of alumina (?) and of iron: it is thus the first colouring-matter which gives directly a green. It resists the action of light and of soap well. Cerulein is very sparingly soluble in water, but dissolves well in water to which has been added a quantity of sodium bisulphite solution of sp. gr. 1·39 equal in weight to the dye-ware to be used. In this case ceruline, a reduction-product, is doubtless formed.

Novel Blue Dye from Anthracen.—According to the *Muster-zeitung* Dr. Springmühl has discovered a splendid blue colouring-matter among the derivatives of anthracen, or rather of some compound not thoroughly known which accompanies anthracen and resembles it in most respects. The preparation of the new dye as described is long and complicated, and the product does not appear to have been submitted to analysis.

Reimann's Färber Zeitung,
No. 21, 1878.

The new dye "aurantia" is now declared to be free from poisonous properties.

By a process recently patented, but the full specification of which has not yet been published, the operation of Turkey-red dyeing has been shortened to one day.

Chemiker Zeitung.
Jahrgang ii., No. 14.

According to the recent experiments of A. Frisch, *Micrococci*, *Bacteria*, and *Bacilli* are not destroyed even by a temperature of −87·5°. No disinfecting action can therefore be produced by cold.

MISCELLANEOUS.

Sewage Farming at Gennevilliers, Paris.—The proceedings undertaken by M. Greyveldinger against the City of Paris ou account of the alteration of the place for obtaining water at Epinay—a change due to the diversion oi the sewage into the Seine at Clichy and at St. Denis—have just terminated, after a duration of twelve years, by the condemnation of the City of Paris. On July 26th, 1876, the Council of the Prefecture of the Seine, after having heard M. de Valroger, advocate of the Commune of Gennevilliers, ordered a scientific investigation, and by its decree of the said date laid before the experts the questions following:—

1. To what cause must be ascribed the inundations which are produced in the cellars? The experts will especially consider the comparative height of water in the wells of Gennevilliers, and in those of circumjacent localities; they will decide if the underground waters have been raised above their natural level by reason of the diversion of the sewage.
2. If an alteration due to such diversion has been discovered in the quality of the well-waters.
3. If the sewage occasions an offensive odour.
4. If it gives off emanations capable of occasioning intermittent fevers; and in general they will examine if the diversion of waters coming from the sewers of the City of Paris, on to the plain of Gennevilliers, may be a cause of inconvenience and ill-health for the inhabitants of the Commune.

The Council of the Prefecture appointed three experts, among whom were MM. de Lagrené and Boussingault. These gentlemen having declined to act, the Council selected MM. Müller, Huttean, and Petiton, who, after a long and conscientious examination, have just presented their report. We have obtained information of this at the Registry of the Prefecture, and we can without any indiscretion announce to those concerned that this report is favourable to the Commune of Gennevilliers. MM. the Experts unanimously conclude that the effect of the diversion of the sewage produces at Gennevilliers a mean rise of the underground waters of from 90 centimetres to 1 metre 25 centimetres. They do not think that the alteration of the water in the wells is imputable to the said diversion. They declare that the sewage diffuses an offensive odour. They do not decide on the question whether the sewage diffuses emanations capable of occasioning intermittent fevers, but they do not hesitate to express their opinion that the diversion is a cause of inconvenience and ill-health to the inhabitants. MM. the Experts sum up their report with the general conclusion that the diversion of the sewage has raised the level of the underground waters, and that the best means of avoiding this inconvenience is a regulation of the distribution of the waters combined with rational drainage. We shall return to this important document, which comprises no less than 150 pages of text, besides illustrative plans.

Manchester and Salford Sanitary Association.—This Association has determined to widen its sphere of usefulness by instituting a Sanitary Inspection Department, the objects of the Department being, *first*, to provide its members, at moderate cost, with such advice and supervision as may ensure the proper sanitary condition of their own dwellings; *secondly*, to enable members to procure practical advice, on moderate terms, as to the best means of remedying defects in houses of the poorer classes, and any other premises in which they are interested. Persons may become members of the Department upon payment of an annual subscription of £1 1s., which gives the privilege of an annual inspection and written report by an engineer of the Association, on the sanitary condition of one dwelling or tenement, with specific recommendations, if necessary, as to the improvement of drainage, water supply, and ventilation; and of reports by the Officers of the Association as to the sanitary condition of any dwelling or tenement designated by any member, on payment of a fee of 2½ per cent on the rent for the first inspection, and 1 per cent for any subsequent inspection. The sanitary condition of the country would be speedily improved if other towns would follow this excellent example of Manchester.

NOTES AND QUERIES.

Formic and Acetic Acids.—(Reply to H. B. G.)—The best test for the distinction of formic and acetic acids when mixed together is to make the solution neutral, and add $AgNO_3$. The white precipitate of $C_2H_3AgO_2$ will be soluble in hot water, whilst the precipitate $CHAgO_2$ will rapidly darken, and metallic Ag will be produced. —A. E. Menke

INDEX.

ABNE De Wiveslie W., "Treatise on Photography" (review), 159
Acetates, acid, 42
Acetic acid, dibromide of, 173
in vinegar, 173
and formic acids, 276
Aceto-nitranilide and nitranilide, action of potassium nitrite on, 113
Aceto-phenon, derivatives of, 7
Acetyl-chloral-alcoholate and tetra-chlor-ether, behaviour of with potassium cyanide and alcoholic potassa, 274
Acid acetates, 42
boracic, observations on by M. Bidaud, 112
carbonic, anthraquinon, oxyanthraquinon, and alizarin, 162
proportion of in ground air, 204
decomposition of ultramarine by, 213
chlorides, action of oxygen on, 195
and analogous compounds, action of oxygen upon, 203
dibromide of acetic, 173
dichloro-propionic, 7
ethylenlactic, 250
formic, 174
glycollic, preparation of, 110
hydrocyanic, action of, 174
nitranilic, 174
nitric, solution of molybdate of ammonia in, 98
in he vitriol manufacture, 155
normal methyl oxybutyric and its derivatives, 228
of the gastric juice, 153
persulphuric, 73, 102
formation of during electrolysis, 82
phthalic, synthesis of, 220
rosolic, 52
sulphuric, 167, 192, 207
chambers, patent for supplying with nitre, 203
loss of nitre in the manufacture of, 147
solution of platinum in, 237
sulphurous, injury done to forests by, 204
tartaric, new pyrogenous derivative for, 147
pyrogenous derivative of, 250
Acids, anhydrous, and water, 21
formic and acetic, 276
free mineral, detection and estimation of in various commercial products, 211, 237
organic, in the examination of minerals, 14, 24, 65, 86, 98, 148
pyrotritaric and carbo-pyrotritaric, 270
replacing, 84
stable anhydrous, action of upon stable anhydrous bases, 21
Aconites, alkaloids of the, 67, 245
Adams, W. G., new form of polariscope, 271
Ador, E., and A. Sauer, determination of nitrogen in nitroglycerin of dynamite, 6
"Aerzte, Medizinische Jahrbucher, heraus gegeben von der K. K. Gesellschaft der" (review), 60
Affleck, J., sulphuric acid, 167, 192, 207
"Agricultural Chemistry and Geology" (review), 17, 61
Air, detection of ozone in, 262
Albumen in serum and in milk, 22
Alcohol and ether, solubility of certain organic acids in, 249
cuminic, production of cymol from, 263
reagent for, 62
Alcoholic chlorides, preparation of, 21
fermentation of vegetables, intra-cellular, 74
potassa, 203
solution of potassa, action of upon chloroform, 52
Alcohols, action of anhydrous sulphurous acid on, 264
of dried oxalic acid on the primary, secondary, and tertiary, 227
formation of corresponding, in the preparation of aldehyds on Piria's method, 205
peculiar reaction of certain polyatomic, 133, 196
Aldehyds on Piria's method, formation of corresponding alcohols in the preparation of, 205
Alger, Lack, and Burnard, patent for supplying sulphuric acid chambers with nitre, 263
Algeria, industrial application of solar heat in, 227
Alizarin, blue, 204
carbonic acid, 162
Alkali manufacture, improved system of, 16
Alkalies, role played by carbon in reducing the sulphates of the, 271
Alkalimetric indicator, 228
Alkalimetry, new indicator in, 275
Alkaline hypobromite, action of on ammonium salts, urea, and oxamide, 270
Alkaline oxy-salts, action of the copper-zinc couple on, 68
sulphides and carbonates, determination of caustic alkali in presence of, 83
Alkaloids, cadaveric, and importance in toxicology, 264
of the aconites, 67, 245
temperature at which some of them sublime, 167
Allantoin and hippuric acid in the urine of dogs, 275
Allotropic varieties of magnetic oxide of iron, 142
Aluminium and gallium, alloys of, 274
and iron, separation of vanadium from, 113
Aluminium, oxidation of, 228
Amber, natural distinguished from artificial, 31
American Association for the Advancement of Science, 265
"American Pharmaceutical Association, Proceedings of" (review), 119
Amides, transformation of nitriles into, 161
Amidines and monobasic organic acids of the thiamides, 262
Amine bases with hydro-ferrocyanic acid, certain compounds of, 63
Amines, aromatic, 204
Ammonia, nitrogen as, action of upon crops, 204
on anthra-purpurin, 110
on isatin, 93
crenate of and urea in spring waters, 233
heat of formation of metallic chlorides united with, 217
in filtered water, 9, 19, 30, 38, 79, 93, 111
manufacture of salts of, 154
Ammoniacal derivatives of chloral, 51
Ammonium nitrite, formation of, 174
salts, urea, and oxamide, action of alkaline hypobromite on, 270
sulphocyanide in volumetric analysis, 77
tri-iodide, 246
Ampère and Avogadro, researches on the law of, 262
Amyl, hippurate of, 263
Amylen, preparation of, 122
Amylens and amylic alcohols, 93
Analyses of steel, 226
quantitative, colour-comparator for, 229
Analysis, chemical, separation of minerals for, 108, 120, 152, 160
eudiometric, of mixtures of paraffins, 226
of butter, 7, 20
of cane-sugar ash, 76
of cane- and beet-root-sugar ash, 127
of glass, 183
of silicates by lead oxide, 112
of soils, 204
of sugar, 37
of tin crystals, 244
of wines, 94
quantitative spectral, 31
volumetric, ammonium sulphocyanide in, 77
of phenol, 203
"Analysis, Volumetric Handbook of" (review), 226
Anatomic elements, action of oxygen on the, 123
Anethol, action of boron fluoride on, 142
Anhydrous acids, action of stable upon stable anbydrous bases, 21
sulphurous acid, action of upon alcohols, 264
Anhydrous acids and water 21
Aniline violet, conversion of magenta into, 250
Animal and vegetable food, preserving, 221
Anisoil, new derivatives of, 109
Ansell's fire-damp indicator, 163
Anthon, F., formation of fructose from sucrose and sulphuric acid, 133
Anthracen, compounds occurring in crude, 250
novel blue dye from, 276
Anthraquinon carbonic acid, 162
Anthrapurpurin, action of ammonia on, 110
Apelt, E., fixation of cosin upon cotton, 196
Apparatus, blowpipe, 114
Aqueous vapour, distillation of aromatic bodies with, 7
Areometers, 241, 267
Armsby, H. P., absorption of bases by the soil, 204
Armstrong, Dr., and Mr. Easkell, action of iodine on camphor, 4
Matthews, bromo-derivatives of camphor, 4
on the constitution of terpenes and camphor, 4
poisonous principle o urechites suberecta, 166
Aroma of butter, 31, 50
Aromatic amines, 204
action of chloride of iodine on, 162
bodies, distillation of with aqueous vapour, 7
nitrosamines, 129
sulphones, 162
Arsenic, new way of separating from other metals, 196
Arsenides, formation of metallic, 227
"Arts, Manufactures, and Mines, Dictionary of" (review), 259
Asmannshausen, warm springs of 31
Atmosphere, presence of hydrogen peroxide in the, 35
Atmospheric air, nitrogen, and hydrogen, 11
hydrogen peroxide, 275
Atomic weight of gallium, 138
weights of the elements, relations among, 161, 255
Attfield, J., chemists and chemists, 112, 131
Institute of Chemistry, 92
Aurin, 213, 275
Austen, P. T., simple laboratory manipulations, 146
Australia, chemical profession in, 120
Auxiliary acids, part played in etherification of, 273
Avogadro and Ampère, law o 262
Ayrton, Prof., electrical properties of bees'-wax and lead chloride, 247
Azophenols, 238

BADOUREAU, M., metallurgy of nickel, 94
Baily, W., effect of starch salicene, &c., on polarised light, 271
Ballo, M., examination of water at Buda-Pest, 274
Baker, W., serious accident to, 185, 228
Barium carbonate, dissociation of, 103
strontium, and calcium, volatility of, 63
Barth, M., Invertin, 275
Baryta, solubility of in solutions of sugar, 134
Bases, absorption of by the soil, 204
Battery, Byrne's pneumatic, 140
telephone, 122
Bayley, T., behaviour of metallic solutions with filter-paper, and the detection of cadmium, 211
improved form of washing-bottle, 110
Béchamp, A., and G. Eustache, cause of spontaneous alteration of eggs, 62
Beckurts, H., and R. Otto, dichloro-propionic acid, 7
formation of dichlor-propionic acid from pyruvic acid, 238
Becquerel, H., researches on rotatory magnetic purification, 41
"Beer-adulterations, &c." (review), 171
Bees'-wax and lead chloride, electrical properties, 247
Beet-root and cane-sugar ash, analyses of, 127
sickness in soils, 204
Beets, sugar-cultivation of, 133
Beilstein, F., laboratory at St. Petersburg, 263
and A. Kurbatow, action of sulphuretted nitrogen on nitro-compounds, 6
dichlor-anilines, 173
Benedikt, R., and P. Weselsky, azophenols, 238
mono-nitro-pyro-catechin, 228
Bengale rose, 196
Benzerythren, 162
Benzin and toluen, direct fixation of sulphur and oxygen on, 203
Benzol, luminosity of when burnt with non-combustible gases, 36, 61, 72, 101
Benzoyl, action of chloride of on leucin, 122
"Bericht Handels, vom Monat, April, 1878" (review), 248
Bernthsen, A., amidines and monobasic organic acids of the thiamides, 262
and H. Klinger, sulphin compounds of thio-urea, 275
Berthelot, M., action of an alcoholic solution of potassa on chloroform, 52
oxygen on acid chlorides, &c., 195
upon the acid chlorides and analogous compounds, 203
anhydrous acids and water, 21
certain melting-points, 52
chemical reactions on the electric effluve and upon persulphuric acid, 102
chloral and its hydrate, 21
definite hydrates formed by the hydracids, 102
formation of oxygenated water, ozone, and persulphuric acid during electrolysis, 82
limits of etherification, 21
liquid contained in a very ancient glass vase, 52
new observations on pressure in chemical phenomena, 41
part played by auxiliary acids in etherification, 273
persulphuric acid, 73
relative affinities and reciprocal displacements of oxygen and the halogens combined with metals, 152
Berthelot, M., rotatory power of meta-styrolen, 40
specific heats and melting heat of gallium, 195
stability of ozone, 83
thermic formation of isomeric bodies, 21
Bert, P., action of oxygen on the anatomic elements, 123
Bertrand, E., leadhillite of Matlock, 112
Beryllium, specific heat of, 224
Bessemer ingots, preparation of steel plates from, 220
steel, oxygen in, 48
specific gravity of, 199
Bettendorff, A., separation of vanadium from iron and aluminium, 113
Betulin, 3. 51, 161
Bevan, E. J., new form of apparatus for fractional distillation, 183
Bidaud, M., observations on a memoir by M. Dieulafait on boracic acid, 112
Biellese molybdenite, 51
Bischof, G., ammonia in filtered water, 79
Bishop's process of lime generation, 89
Bismuth compounds, 130
subnitrate, detection of plumbic oxide in pharmaceutical, 184
Blaikley, D. J., brass wind-instruments as resonators, 222
Blowpipe apparatus, 184
chemistry, contributions to, 200
Blue alizarin, 204
and green ultramarine, 174
chrome, 133
dye, novel, from anthracen, 276
manganese, 133
Blues, vat, new discharge for, 250
Blunt, T. P., and A. Downes, action of sunlight upon solutions of oxalic acid, 19
Blyth, A. W., stopcock flask, 20
temperature at which some of the alkaloids, &c., sublime, 167
Boasson and Noelting, MM., aromatic amines, 204
Boiling-points, determination of, 68, 212
Bohlig, G., direct manufacture of soda and potassa from their chlorides, 52
Böhn, J., discolouration of green leaves in intense sunlight, 133
disengagement of oxygen from green twigs submerged in water previously boiled and exposed to the sun, 251
Bolton, H. C., application of organic acids to the examination of minerals, 14, 24, 65, 86, 98
Bong, G., analysis of silicates by means of lead oxide, 112
manganese-blue and chrome-blue, 133
Boracic acid, observations on by M. Bidaud, 112
Boric acid in presence of mannite, reaction of, 133
fluoride, action of upon certain organic matters, 153
Borneo camphor, 275
Boron fluoride, action of upon organic substances, 123
on anethol, 142
Bourgoin, E., new pyrogenous derivative of tartaric acid, 147, 250
solubility of certain organic acids in alcohol and ether, 249
Bourrouze, M., suppression of return wire in the telephone, 237
Boussingault, M., carburation of nickel by the cementation process, 122
Bottomley, J., determining the coefficients in chemical equations, 110
Boutroux, L., lactic fermentation, 142
Braithwaite, W., "Retrospect of Medicine" (review), 60
Brass wind-instruments as resonators, 222
Breguet, A., modifications of the telephone, 74, 83
telephone of Bell and the string telephone, 121
Breuer, A., and T. Zincke, substances formed from hydro- and iso-hydro-benzoin by the action of dilute sulphuric acid, 162
Bromacetyl-bromide, action of upon zinc-methyl and zinc-ethyl, 174
Bromine, action of upon sulphur, 212
iodine, and nitrate of potash, manufacture of, 56
Bromo-derivatives of camphor, 4
Browning, J., "How to Work with the Spectroscope" (review), 226
Brown, C., trimethyl-sulphine, 130
Brucine, coloured crystalline compounds, 98
Brugnatelli, J., rapidly evaporating a large quantity of liquid, 205
Bruylants, G., connection of the chemical compounds in volatile oils, 275
products of the dry distillation of calcium pimarate, 274
Buchanan, J. Y., laboratory experiments on board the Challenger, 88
Buda Pest, examination of water at, 274
Burghardt, C. A., decomposition of water by iron pyrites, 49
occurrence of dioptase on chrysocolla from Peru, 223
origin of some ores of copper, 215
Burnard, Lack, and Alger, Messrs., Burnard's patent for supplying sulphuric acid chambers with nitre, 203
Busch, J., behaviour of tetrachlor-ether and acetyl-chloral alcoholate with potassium cyanide and alcoholic potassa 274
"Bussey Institution, Bulletin of" (review), 261
Butan, nitro-, normal, 173
Butter analysis, 7, 20
aroma of, 31, 50
detection of fatty bodies introduced into, 163
fat in, 173
Byrne's pneumatic battery, 140

CADAVERIC alkaloids, importance in toxicology, 264
Cadmium, detection of, 211
Cahours and Demarcay, MM., action of dried oxalic acid on the primary, secondary, and tertiary alcohols, 227
Cailletet, L., condensation of oxygen and carbonic oxide, 40
liquefaction of gases, 83
Calcium, barium, and strontium, volatility of, 63
chloride, certain properties of, 10
oxalate, formation of crystals of in urine, 76
pimarate, products of the dry distillation of, 274
Cameron, C. A., and J. F. W. Johnston, "Agricultural Chemistry and Geology" (review), 17, 61
Campani, G., hippurate of amyl, 263
Camphor, action of iodine on, 4
and terpenes, constitution of, 45
Borneo, 275
bromo-derivatives of, 4
group, studies on the compounds of the, 174
motions of on the surface of water, 72
new chloride of, 238
Candles, alteration of by long exposure to sea-water, 165
Cane and beet-root sugar-ash analyses of, 127
sugar-ash, analysis of, 76
Cantal, maturation and diseases of the cheese of the, 21
Carbides of hydrogen, new synthetic method for the formation of, 274
Carbolic test for nitric acid, 3
Carbon bisulphide, action of iodine trichloride on, 224
of plants, origin of, 153
role played by in reducing the sulphates of the alkalies, 271
Carbonated, new cupric liquid for the determination of glucose, 142
Carbonates and alkaline sulphides, determination of caustic alkali in presence of, 83
Carbonic acid, anthraquinon, oxy-anthraquinon, and alizarin, 162
decomposition of ultramarine by, 213
in ground-air, proportion of, 204
oxide and oxygen, condensation of, 40
Carbonisation of vegetable matter mixed among wool, 276
Carbo-pyro-tritaric and pyro-tritaric acids, 270
Carburation of nickel by the cementation process, 122
Carnot, A., detection of plumbic oxide in pharmaceutical bismuth subnitrate, 184
volumetric method of determining potassa, 122
Carnelly, T., and W. C. Williams, determination of high boiling points, 212
Capron, J. R., "Photographed Spectra" (review), 118
Casamajor, P., areometers, 241, 267
contributions to blowpipe chemistry, 200
Cast-steels, chemical and mechanical analyses of, 200
Catechins, the, 153
Caustic alkali, determination of in presence of alkaline sulphides and carbonates, 83
Cellulosic substances carbonised with concentrated sulphuric acid, disinfecting properties of, 32
Cerulein and gallein, 276
Challenger, laboratory experiments on board the, 88
Challes, in Savoy, mineral waters of, 142
Cheese of the Cantal, maturation and diseases of the, 21
Chemicals, dyers', 33, 43, 55, 75, 105, 145, 188, 258
Chemical and Physical Society, University College, 118
Newcastle-upon-Tyne, 167, 192, 207
Chemical Society, 36, 67, 87, 109, 123, 128, 139, 141, 150, 166, 190, 211, 245, 279
Edinburgh University, 60, 89, 100, 130, 216
Research Fund, 63, 74
Soirée, 238
Chemists and chemists, 101
Chemistry, application of the microscope to special branches of, 150
"Chemistry, Applied, Pure, and Physical, Experimental Researches on" (review), 69
"Chemistry, Elements of" (review), 226
"Chemistry, Industrial" (review) 234
Chemistry, Institute of, of Great Britain and Ireland, 18, 19, 29, 30, 38, 39, 51, 57, 80, 92, 252
Chevreul, E., extract from a work entitled "On the Vision of Colours, &c.," 203
vision of colours, 227

Chemist and Druggists' Diary for 1878, 71
Chinoline and lepidine, action of sodium on, 85
Chloral, ammoniacal derivatives of, 51
and its hydrate, 21
observations on a paper upon, 227
Chlorhydrin in tanneries, use of 22
Cholera, telluric theory of, 31
Chlorine, hydrate of, dissociation of, 122
Chlorides, acid, and analogous compounds, action of oxygen on, 203
direct manufacture of soda and potassa from their, 52
metallic, heat of formation of united with ammonia, 217
preparation of alcoholic, 21
Chloroform, action of an alcoholic solution of potassa on, 52
Cholesterin and phytosterin, 263
Chrome-blue, 133
residues, 196
Chrysocolla from Peru, occurrence of dioptase on, 223
Church, A. H., application of Sonstadt's solution to the separation of minerals for chemical analysis, 160
"Food" (review), 225
"Plain Words about Water" (review), 225
Citric acid as a constituent of imperfectly ripe mulberry juice, 6
Civil Engineers, Institution of, 228
Civilisation and Myopism, 32
Clark, A. W., new method of weighing precipitates, 109
W. J., gallate and tannate of iron, 216
Climate, influence of soil and forests upon, 10
Cloez, S., production of liquid and gaseous hydrocarbons, 274
Coal-gas, new product from, 95
Coleman, J. J., constitution of malt liquors, 177
Collins, J. H., "Mineralogy" (review), 160
Colouration of water, 94
Colour-comparator for quantitative analyses, 229
Coloured flames, transparence of for their own radiations, 237
Colours, complementary, 272
vision of, 227
Combustion, incomplete, 174
Coniferin, cork, and xylophitin, 28
Coniters, influence of "leafwood," compared with on the rain and moisture of the air, 204
Conroy, Sir J., light reflected by potassium permanganate, 247
Cooke, Prof., the radiometer, 251
Copper, action of sulphuric acid on, 36
allotropic modification of, 274
extraction, 80
from copper pyrites with the aid of two waste-products, 65
occlusion of hydrogen by, 271
origin of some ores of, 215
Copper-zinc couple and occluded and nascent hydrogen, 245
Coppola, M., electrolytic researches on certain glucosides, 263
Coquillion, M., action of watery vapour upon the hydrocarbides raised to a red-heat, 262
application of palladium wire for the determination of hydrocarbides mixed with air in small proportions, 10
Coralin, constituents of, 238
Corenwinder, B., chemical composition and functions of the leaves of plants, 142
Corfield, W. H., butter analysis, 7, 30
Cork, xylophilin, and coniferin, investigations on, 28
Cornu, A., consequences of the constitution of the solar spectrum, 123
dark rays of the solar spectrum and the constitution of the sun, 102
ultra-violet solar spectrum, 123
Crafts and Friedel, MM., direct fixation of oxygen and sulphur upon benzin and toluen, 203
Crookes, W., repulsion resulting from radiation, 102
Cross, C. F., and S. Suguira, action of the halogens at high temperatures on metallic oxides, 270
new method of weighing precipitates, 116
retention of saline impurities by hydrated ferric oxide, 26
Crude benzines, nature of the highly volatile products contained in, 104
Crystalline silicic acid when mixed with silicates, separation of, 162
Cossa, A., molybdenite of Biellese, 51
Cuminic alcohol, production of cymol from, 263
Cotton, fixation of eosin upon, 196
Curarin, 175
Cupric liquid, new carbonated, for the determination of glucose, 142
Cuprous chloride, 6
Cyanide, double salts of thallous, 162
Cyanides, volumetric estimation of, 129
Cymol, production of from cuminic alcohol, 263
Cynanchol, 263

DALE, R. S., and C. Schorlemmer, aurin, 213
Daremberg, G., detection of ozone in the air, 262
Daubrée, M., constitution and structure of the meteoric irons of Santa Caterina, 61
Davis, G. E., copper extraction, 80
estimation of nitrogen compounds in oil of vitriol, 45
nitric acid in the vitriol manufacture, 155
nitre losses in vitriol manufacture, 195, 216
vitriol from absorbing and denitrating towers, 125
Davyum, remarks on, 65
Death, J., ammonia in filtered water, 38, 111
De Boisbaudran, L., alloys of gallium and aluminium, 274
equivalent of gallium, 216
new mineral discovered by Mr. Lettsom, 228
Debray, H., and H. Ste.-Claire Deville, new compound of palladium, 216
new product of the oxidation of lead, 122
Deby, J., report on the progress of the iron and steel industries in foreign countries, 261
Decaisne and Pettenkofer, MM., telluric theory of cholera, 31
De Clermont and De Frommel, MM., dissociation of sulphides in presence of boiling water, 250
separating arsenic from other metals, 196
De Champvallier, L., the telephone, 83, 112, 121, 134, 153
Delachanal, M., and C. Vincent, nature of the highly volatile products contained in crude benzines, 104
De la Loyère and Muntz, MM., production of sulphuretted oils possessing insecticide properties, 262
De la Rue, W., and H. W. Müller, electric discharge in tubes containing rarefied gases, 237
De Leeuw, C., use of waste-waters of starch works, 133
De Loynes, M., experiments of M. Raoul Pictet on the liquefaction of oxygen, 41
Demarcay, E., and M. Cahours, action of dried oxalic acid on the primary, secondary, and tertiary alcohols, 227
derivatives of isobutylic ether, 237
isobutyl-acetyl-acetic ether, 237
Denitrating and absorbing towers, vitriol from, 125
Destrem, A., action of chloride of benzoyl on leucin, 122
Descamps, A., formation of metallic arsenides, 227
Dibromide of acetic acid, 173
Dichlor-anilines, 173
Dichloro-propionic acid, 7
Dichlor-propionic acid from pyruvic acid, 238
Didymium and lanthanum, 250
Dietl, T. H., and V. Merz, derivatives of oxy-naphtho-quinon, 7
Dieulafait, M., boric acid observations by M. Bidaud, 112
Dimethyl-aniline, 173
Dioptase on chrysocolla from Peru, occurrence of, 223
Diplato-nitrites and plato-nitrites, 31
Distillation, new form of apparatus for fractional, 183
Ditte, A., certain properties of calcium chloride, 10
Dittmar, W., eudiometric analysis of mixtures of paraffins, 226
luminosity of benzol, &c., 61, 101
Dobbie, J., and W. Ramsay, decomposition of products of quinine, 37
Douglas, T., possible use for a constituent of gas-lime, 126
Downes, A., and T. P. Blunt, action of sunlight upon solutions of oxalic acid, 19
Dublin University Experimental Science Association, 163, 216
Du Bois-Reymond, telephone, 153
Duclaix, E., elastic forces of vapours given off by a mixture of two liquids, 142
maturation and diseases of the cheese of the Cantal, 21
Dufet, H., variation of indices of refraction in mixtures of isomorphous salts, 203
Dufour, M., fumivorous furnace, 228
Dumas, M., oxygen in metallic silver, 81
Du Moncel, Th., battery telephone, 122
industrial applications of electricity, 152
theory of the telephone, 142
Dupré, A., gallium, 184
substitution of sulphur for oxygen in the fatty series, 153, 250
Durham University, 32
Durham, W., relation between gaseous volume and valency, 194
suspension, solution, and chemical combination, 47
Durol, pseudocumenol, and constitution of pseudocumol-sulphonic acid, &c., 161
Duter's artificial magnets, 83
Duvillier, E., normal methyl-oxybutyric acid and its derivatives, 228
Dyer's chemicals, 33, 43, 55, 75, 105, 145, 188, 258

EASKELL, Mr, and Dr. Armstrong, action of iodine on camphor, 4
Ebermayer, E., use of ferrocyanide in electro-gilding, 22
Ebullition of superposed liquids, 121
Edgeworth, M. P., "Pollen" (review), 50
Edinburgh University Chemical Society, 60, 89, 100, 130, 216
Eggs, cause of spontaneous alteration of, 62
yolk of, 154
Elaterin, test for, 35
Electric discharge in tubes containing rarefied gases, 237
effluve, chemical reactions on, 102
thermo-currents in wires subjected to strain, 118
Electrical properties of bees' wax and lead chloride, 247
Electricity, engraving on glass by, 51
industrial applications of, 152
influence of on evaporation, 142
Electro-gilding, use of ferrocyanide in, 22
Electrolysis, 100
formation of ozone, oxygenated water, and persulphuric acid during, 82
Electrolytic researches on certain glucosides, 263
Elements, relations among the atomic weights of the, 161, 255
Engineers, Civil, Institution of, 228
Eosin upon cotton, fixation of, 196
and fluorescein lakes, for preparing decorative painting without poison, 20
Equations, chemical, determining the coefficients in, 110
Ergotinin, 203
Erlenmeyer, E., ethylen lactic acid, 250
studies on the phosphates, 63
Esilman, A., and P. Spence, detection and estimation of free mineral acids in various commercial products, 211, 237
Etard, A., preparation of amylen, 122
Ether, hydrate of, 184
and alcohol, solubility of certain organic acids in, 249
in chemical combinations, vibrations of matter and the waves of the, 152
in light, vibrations of matter and waves of the, 121
in phosphorescence and fluorescence, vibrations of matter and the waves of, 102
isobutyl-acetyl acetic, 237
isobutylic, derivatives of, 237
the waves of and vibrations of matter in the act of ebullition, 122
waves of and vibrations of matter in photo-chemical combinations, 142
Etherification by means of HCl, 7
limits of, 21
part played by auxiliary acids in, 273
Ethylen oxide, polymerisation of, 262
lactic acid, 250
zinc, and zinc methyl, action of bromacetyl bromide on, 174
Eudiometric analysis of mixtures of paraffins, 226
Europe, use of maté in, 32
Eustache, G., and A. Béchamp, cause of spontaneous alteration of eggs, 62
Evaporation, influence of electricity on, 142
of plants, influence of surface of leaves on, 133

FAT in butter, 173
Fats, cooling of, 131
Fatty series, introduction of nitrogen radicals into compounds of the, 172
Fautrat, M., influence of the soil and forests upon climate, 10
influence of leafwood compared with conifers on rain and moisture of the air, 204

Favé, M., vibrations of matter and the waves of the ether in chemical combinations, 152
in light, 121
in phosphorescence and fluorescence, 102
in photo-chemical combinations, 142
in the act of ebullition, 122
Fecs, 61, 73
Ferments, organised, nitrification by, 52
Ferric oxide, hydrated, saline impurities retained by, 26
Ferrocyanide in electro-gilding, use of, 22
Ferro-manganese, applications of, 113
Fielder, Pokorny, and Co.'s laboratory, work done at, 199
Fire-damp indicator, 163
Fischer, E., certain compounds of the amine bases with hydro-ferrocyanic acid, 63
O. and E., aurin, 275
Fisher, W. W., manganese tetrachloride, 270
Fittig, R., and F. Gebhard, fluoranthene, 174
Fitz, A., schizomycetenic fermentations, 161
Flames, theory of, 153
Flax, manurial experiments upon, 204
Flourens, M., manufacture of sugar-candy, 230
Fluoranthene, 174
Fluorescein and eosin, lakes for preparing decorative paintings without poison, 20
Fluoride, boric, action of on certain organic matters, 153
boron, action of upon organic substances, 123
on anethol, 142
Folkard, C. W., new method of weighing precipitates, 158
"Food" (review), 225
Food preserving, new method, 221
Formic acid, 174
and acetic acids, 276
Forces, elastic, of vapours given off by a mixture of two liquids, 142
Foster, W., action of alkaline hypobromite on ammonium salts, urea, and oxamide, 270
Fractional distillation, new form of apparatus for, 183
Franchimont, A. P., betulin, 161
Frankland, E., and L. T. Thorne, luminosity of benzol when burnt with non-luminous combustible gases, 36
"Experimental Researches in Pure, Applied, and Physical Chemistry" (review), 69
Frerichs, F., and F. Smith, didymium and lanthanum, 250
Fresenius, R., warm springs of Asmannshausen, 31
Freiburg University, communications from the laboratory of, 174
Friedel and Crafts, MM., direct fixation of oxygen and sulphur upon benzin and toluen, 203
Fritz, H., formation of hail, 204
Frommel, M., and De Clermont, new way of separating arsenic from other metals, 196
Froumüller, C., double salts of thallous cyanide, and a new thallous thallic cyanide, 162
Fructose, formation of from sucrose and sulphuric acid, 133
Fühling, J., beet-root sickness in solids, 204
Fumivorous furnace, 228

GADOLINITE, ultra-violet, absorption of the earths in, 237
Gallein and cerulein, 276
Gallium, 78, 184
and aluminium, alloys of, 274
atomic weight of, 138
Gallium, equivalent of, 216
extraction of, 121, 142
specific heats and melting heat of, 195
Galvanometer lantern slide, 79
Gorham, M., complementary colours, 272
Garcin, F., disinfecting properties of cellulosic substances carbonised with concentrated sulphuric acid, 32
Garnier, J., Garnierite, 153
Gas absorber, 165
battery, 79
lime, possible use for a constituent of, 126
liquefaction of, 83
"Gas Users, Common Sense for" (review), 235
Gaseous hydrocarbons, production of liquid and, 274
volume and valency, relation between, 194
Gases and vapours, refraction of, 102
combustion of, 142
condensation of hitherto supposed permanent, 62
electric discharge in tubes containing rarefied, 237
luminosity of benzol when burnt with non-combustible, 36, 61, 72, 101
Gastric juice, acid of the, 153
Gaugain, J., transient variation of permanent magnetism, 123
Gautier, A., the catechins, 153
Gebhard, F., and R. Fittig, fluoranthene, 174
Gennevilliers, sewage farming at, 276
"Geology, Agricultural Chemistry and" (review), 17, 61
Gerland, B. W., sulphates of the vanadium tetroxide, 11
vanadium pentoxide, 127, 138, 162
German refineries, extraction of platinum metals as in, 112
Gernez, D., ebullition of superposed liquids, 121
Geyer, W. E., and H. Morton, paraffins in commercial water-gas, 187
Gladstone, J. H., and A. Tribe, action of the copper-zinc couple on alkaline oxy-salts, 68
analogies between the action of the copper-zinc couple and occluded and nascent hydrogen, 245
some candles altered by long exposure to sea-water, 165
Glass, analyses of, 183
vase, liquid contained in a very ancient, 52
Glucinium, specific heat and physical properties of, 195
Glucose, new carbonated cupric liquid for the determination of, 142
&c., reagent for reducing, 263, 264
Glucosides, electrolytic researches on certain, 263
Glycollic acid, preparation of, 110
Glycerin, isomer of the monochlor-hydrin of, 238
test for, 246
Gold contained in old toning-baths, new method of precipitating, 249
Gooch, F. A., new method for the separation of precipitates, 181
Gore, G., gas absorber, 165
Gouy, M., transparence of coloured flames for their own radiations, 237
Govi, G., absorption of radiation through bodies, and its application to quantitative spectral analysis, 10
absorptions of radiations across bodies, 46
Gradmann, A., and W. Michler, dimethyl-aniline, 173
Grapes, maturation of, 122
ripening process of, 251
Green and blue ultramarine, 174
Guignet's preparation of, 249
Gressier, M., telegraphic use of the telephone, 237
Grete, E. A., potassium xanthogenate for the quantitative determination of carbon bisulphide, &c., in presence of alkaline carbonates, 63
and R. Zœller, formation of ammonium nitrite, 174
Grosheintz, H., preparation of methyl-allyl, 131
Grosjean, B. J., ammonia in filtered water, 19
Grossmann, J., estimation of hyposulphites and sulphites, 224
Groves, C. E., and J. Stenhouse, history of the naphthalene series, 270
gas battery, 79
Institute of Chemistry, 29
Guaiacum resin as a reagent for salts of copper, 264
Guano, consumption of, 175
Guignet's green preparation, 249
Guimet, E., memoir on ultramarines, 113
remarks on M. Plicque's note on artificial ultramarine, 52
reply to, 94
Gunning, F. W., separation of media free from oxygen, 31
Guyard, A., synthesis of phthalic acid, 220

HAIL, formation of, 204
Halogens and oxygen combined with metals, relative affinities and reciprocal displacements of the, 152
at high temperatures, action of on metallic oxides, 270
Hammerschlag, W., anthraquinon carbonic acid, oxy-anthraquinon carbonic acid, and alizarin carbonic acid, 162
"Handels Bericht vom Monat, April, 1878" (review), 248
Hannay, J. B., action of bromine upon sulphur, 212
iodine trichloride upon carbon bisulphide, 224
volumetric estimation of cyanides, 129
Hanriot, M., isomer of the monochlor-hydrin of glycerin, 238
new method of preparing propyl-glycol, 238
Hardman, E. T., application of Sonstadt's solution to the separation of minerals for chemical analysis, 152
separation of minerals for chemical analysis, 108
Harmonograph, 79
Harrow, G., pyrotritaric and carbotritaric acids, 270
Hart, E., "Handbook of Volumetric analysis" (review), 226
Hartley, W. N., action of sunlight upon solutions of oxalic acid, 9
Haugh, F., new method of precipitating the gold contained in old toning-baths, 249
Hautefeuille, P., crystallisation of silica in the dry way, 237
reproduction of quartz by the dry way, 262
HCl, etherification by means of, 7
Heat, action of watery vapour on hydrocarbides raised to a, 262
production of by a chemical action, 262
Hell, C., and O. Mühlhäuser, dibromide of acetic acid, 173
Henderson, M., applications of ferro-manganese, 113
Henry, L., etherification by means of HCl, 7
Hesse, O., cynanchol, 263
optical rotatory power of liquids and dissolved substances, 263
phlorose, 263
hytosterin and cholesterin, 263
Hill, H. B., pyroxanthin, 275
Hinton C. H., co-ordination of space, 272
Hippurate of amyl, 263
Hippuric acid and allantoin in the urine of dogs, 275
History; how is it written? 123
Houston, E. J., and E. Thomson, relaying of the telephone, 255
How, Prof., reactions with Lindo's test for opium bases, 244
Hüfner, G., quantitative spectral analysis and a new spectrophotometer, 31
Hughes, D. K., action of sonorous vibrations, 197
physical action of the microphone, 246
Hunnius, H., derivatives of acetophenon, 7
Husson, C., detection of fatty bodies fraudulently introduced into butter, 163
Hunt, R., "Ure's Dictionary of Arts, Manufactures, and Mines" (review), 259
Hydracids, definite hydrates formed by, 102
Hydrate of chlorine, dissociation of, 122
Hydro- and isohydro-benzoin, by the action of dilute sulphuric acid substances formed from, 162
Hydrocarbides mixed with air in small proportions, palladium wire for the determination of, 10
raised to a red heat, action of watery vapour on the, 262
Hydrocarbons obtained from Pinus sylvestris, 5
production of liquid and gaseous, 274
Hydrochloric acid, action of upon chemical compounds, 246
Hydro-cyanic acid, action of, 174
Hydro-ferrocyanic acid, certain compounds of the amine bases of, 63
Hydrogen, occluded and nascent, analogies between the action of the copper-zinc couple and, 245
and nitrogen, liquefaction of 311
liquefaction and solidification of, 23, 83
occlusion of by copper, 271
peroxide, atmospheric, 35, 275
Hydrophobia, prevention of, 94
Hydroquinons, nitro-derivatives of the, 275
Hygiene, Nature's, 19
Hypobromite, alkaline, action of on ammonium salts, urea, and oxamide, 270
Hyposulphites and sulphites, estimation of, 224

INCANDESCENCE lamp, new electric, 262
Indigo-blue from Polygonum tinctorium, &c., 223
Indol, synthesis of, 21
"Industrial Chemistry" (review), 234
Inosite, muscular, and the vegetable sugars of same composition, identity of, 122
Insecticide properties, production of sulphuretted oils possessing, 262
Institute of Chemistry of Great Britain and Ireland, 8, 18, 19 29, 30, 38, 39, 51, 57, 80, 92 252
Institution of Civil Engineers 228
Intra-cellular alcoholic fermentation of vegetables, 74
Invertin, 275
Iodine, action of on camphor, 4
of ozone upon, 183
bromine, and nitrate of pot ash manufacture of, 56

Iodine, chloride of, action of on aromatic amines, 162
trichloride, action of upon carbon bisulphide, 224
Iron, ancient metallic, 104
and aluminium, separation of vanadium from, 113
and steel, estimation of phosphorus in, 68, 80
coating with metallic oxide, 220
gallate and tannate of, 216
meteoric, of Santa Caterina, constitution and structure of, 61
perchloride of and concentrated sulphuric acid, action of on some of the bases in opium, 158
pyrites, decomposition of water by, 49
"Iron and Steel Industries, Foreign Progress of" (review), 261
Isambert, M., chloride of sulphur, 153
dissociation of barium carbonate, 103
of the hydrate of chlorine, 122
heat of formation of metallic chlorides united with ammonia, 217
Isobutyl-acetyl-acetic ether, 237
Isobutylic ether, derivatives of, 237
Isohydro- and hydro-benzoin, by the action of dilute sulphuric acid substances formed from, 162
Isomer of the monochlorhydrin of glycerin, 238
Isomeric bodies, thermic formation of, 21
Isomorphous salts, variation of the indices of refraction in mixtures of, 203
Izarn, M., telephone, 262

JACKSON, E., loss of nitre in the manufacture of sulphuric acid, 147
Jacquemart, M., reagent for alcohol, 62
Japan, Tokio University, 265
Jehn, C., acetic acid in vinegar, 173
oxidation of aluminium, 228
Johnson, G. S., ammonium triiodide, 246
certain poly-iodides, 110
occlusion of hydrogen by copper, 271
J. F. W., and C. A. Cameron, "Elements of Agricultural Chemistry and Geology" (review), 17, 61
Jones, F., action of reducing agents on potassium permanganate, 36
G., analysis of sugar, 37
H. C., determination of boiling-points, 68
T., ammonia in filtered water, 9, 30, 93
Juice, lemon, testing, 251
Jungfleisch, E., and L. de Boisbaudran, extraction of gallium, 121, 142

KACHLER, J., Borneo camphor, 275
studies on the compounds of the camphor group, 174
Kelly, O. F., action of ethyl-chlorcarbonate on some oxygenated haloid compounds of the fatty series, 271
Kern, S., analyses of glass, 183
chemical and mechanical analyses of cast-steels, 200
metallurgical notes, 23
oxygen in Bessemer steel, 48
preparation of steel plates from Bessemer ingots, 220
presence of hydrogen peroxide in the atmosphere, 35
remarks on Davyum, 65
Kern, S., Russian scientific news, 22, 123, 154, 185, 205, 265
solution of molybdate of ammonia in nitric acid, 98
specific gravity of Bessemer steel, 199
Kestner, A. S., determination of natural tartrate of lime in crude tartars, 227
preparation of Guignet's green, 249
solution of platinum in sulphuric acid, 237
Kingzett, C. T., and B. H. Paul, notes on tannins, 68
Klein, D., reaction of boric acid in the presence of mannite, 133
peculiar to certain polyatomic alcohols, 133
F., and A. Perren, transformation of nitriles into amides, 161
Klinger, H., and A. Bernthsen, sulphin compounds of thiourea, 275
König, F., and L. Mutschler, estimation of free oxygen in well-water, 4
J., injury done to forests by sulphurous acid, 204
and W. Lott, action of nitrogen as ammonia and as nitric acid upon crops, 204
Koppeshega, W. F., volumetric analysis of phenol, 203
Kraut, K., production of cymol from cuminic alcohol, 263
Kretzschmar, M., fat in butter, 173
Krusemann, H. D., reduction of levulose, 153
Kurbatow, A., and F. Beilstein, action of sulphuretted nitrogen on nitro-compounds, 6
dichlor-anilines, 173
Kerrmann, F., A. Schultz, and E. Mach, ripening process of grapes, 251

LABORATORY experiments on board the "Challenger," 88
manipulations, simple, 146
spectroscope, measuring apparatus for, 115
of Würzburg University, 263
Ladureau, A., cultivation of sugar beets, 133
Lactic fermentation, 142
of milk sugar, 123
Lactobutyrometer, remarks on by E. Marchand, 113
Laiblin, R., nicotin, 174
Laminary systems of Plateau, production of, 237
Lamy, A., solubility of lime in water, 103
Landolph, F., action of boric fluoride upon certain organic matters, 153
of boron fluoride upon anethol, 142
upon organic substances, 123
new synthetic method for the formation of the carbides of hydrogen, 274
Lantern slide galvanometer, 79
Lanthanum and didymium, 250
Laufer, E., separation of crystalline silicic acid when mixed with silicates, 162
Laurent, L., principal section of Nicol prisms in polarising apparatus, 153
Lead, new product of the oxidation of, 122
oxide, analysis of silicates, 112
Leadhillite of Matlock, 112
Leaf-wood, influence of compared to conifers on rain and moisture in the air, 204
Leaves, vine, physiological function of, 3
Leeds, A. R., colour comparator for quantitative analyses, 229
"Water Supply of New Jersey" (review), 248
Leo, H., substituted thiamides, 174
Lepidine and chinoline, action of sodium on, 85
Leucin, action of chloride of benzoyl on, 122
Levulose, reduction of, 153
Lightning, strange effects of, 196
Light reflected by potassium permanganate, 247
vibrations of matter and waves of the ether in, 121
Lime generation, Bishop's process of, 89
in water, solubility of, 103
sulphate of, solubility of in solutions of sugar, 134
Limpricht, H., reduction of the nitro compounds with stannous chloride, 161
Lindo, D., action of perchloride of iron and concentrated sulphuric acid on some of the bases in opium, 158
carbolic test for nitric acid, 3
coloured crystalline compounds obtained from brucine, 98
test for elaterin, 35
Lindo's test for opium bases, reactions with, 244
Linnemann, E., University of Prague, 262
Liquid, rapidly evaporating a large quantity of, 205
Liquids and dissolved substances, optical rotatory power of, 263
ebullition of superposed, 121
Liquors, constitution of malt, 177
"London Water supply" (review), 100
Loring, M., myopism and civilisation, 32
Losanitch, S. M., meteor of Sokol Banja in Servia, 162
Lott, W., and J. König, action of nitrogen as ammonia and as nitric acid upon crops, 204
Lowe, A. J. G., and A. Senier, test for glycerin, 246
Lucion, R., and E. Solvay, action of stable anhydrous acids on stable anhydrous bases, 21
Luff, A. P., and C. R. A. Wright, alkaloids of the aconites, 67, 245
Lunge, G., determination of nitrous and nitric acids, 274

MACAGNO, H., physiological function of vine-leaves, 2
Macdonald, J. W., analyses of cane and beet-root sugar ash, 127
Macé, M., researches on accidental double refraction, 103
Mach, E., F. Kurmann, and A. Schultz, ripening process of grapes, 251
MacIvor, R. W. E, chemical profession in Australia, 120
Mactear, J., improved system of alkali manufacture, 16
nitric acid in the vitriol manufacture, 194, 216
role played by carbon in reducing the sulphates of the alkalies, 271
Madder colouring matters, 271
Magenta, conversion of into aniline, 250
Magnesia, solubility of in solutions of sugar, 134
Magnetic oxide of iron, two allotropic varieties of, 142
purification, researches on rotatory, 41
Magnetisation, stress of, 212
Magnetism, transient variation of permanent, 123
Magnets, artificial, 83
Magniers, L., and C. St. Pierre, researches on the maturation of grapes, 122
Mallet, J. W., volatility of barium, strontium, and calcium, 63
Malt liquors, constitution of, 177
Manchester Literary and Philosophical Society, 110, 213, 223
Manchester and Salford Sanitary Association, 276
Manganese blue, 133
tetrachloride, 270
Mania metaphysica, 134
Mannite, reaction of boric acid in presence of, 133
"Manufactures, Arts, and Mines" (review), 259
"Manures, artificial" (review), 171
Marchand, E., remarks on the lactobutyrometer, 113
Margattef, J., reproduction of a sulphide, selenide, and telluride of silver in a crystalline state, and of filiform silver, 20
Marzell, J., dyers' chemicals, 33, 43, 55, 75, 105, 145, 188, 258
Mascart, M., influence of electricity on evaporation, 142
refraction of gases and vapours, 102
organic bodies considered in the gaseous state, 262
"Massachusetts, Report of the State Board of Health" (reviews), 60, 260
Matches, safety, 104, 114
"Materia Medica, Key to Organic" (review), 249
Maté, use of in Europe, 32
Matlock, leadhillite of, 112
Matter, vibrations of and the waves of the ether in phosphorescence and fluorescence, 102
Matthews and Armstrong, Messrs. bromo-derivatives of camphor, 4
Maumenené, E. J., alcoholic potassa, 203
Mayer, A., analysis of soils, 204
J., Bishop's process of lime generation, 89
Mazzara, G., reagents for glucose, 264
Mechanical and chemical analyses of cast-steels, 200
Media free from oxygen, separation of, 31
"Medicine, Retrospect of" (review), 60
"Medizinische Jahrbücher heraus gegeben von der K. K. Gesellschaft der Aerzte" (review), 60
Mees, R. A., theory of flames, 153
Meldola, R., new yellow colouring matter, 56
Melilotal, 196
Melting-points, 52, 212
Menke, A. E., formic and acetic acids, 276
salts of nitrous oxide, 270
Merz, J., and T. H. Dietl, derivatives of oxynaphthoquinon, 7
and F. Tibirica, formic acid, 174
Merrick, J. M., sugar tests, 273
Metal-growth, spontaneous, 172
Metallic arsenides, formation of, 227
chlorides united with ammonia, heat of formation of, 217
iron, ancient, 104
niobium and a new niobium chloride, 25
oxide, coating iron with, 220
oxides, action of the halogens at high temperatures on, 270
solutions, behaviour of with filter-paper, 211
Metallurgical notes, 23
Metallurgy of nickel, 94
Metals, new way of separating arsenic from other, 196
platinum, extraction of as in German refineries, 112
relative affinities and reciprocal displacements of oxygen and the halogens combined with, 152
Meta-styrolen, rotatory power of, 40
Meteoric iron of Santa Caterina, constitution and structure of, 61
Meteor of Sokol Banja in Servia, 162

Methyl-alcohol and water, specific heat of mixtures of, 28
Methyl-allyl, preparation of, 131
Methyl-quinizarin, 7
Metropolitan water, quality and composition of, 53, 63, 154, 202, 236
Meyer, V., determination of vapour densities, 172
introduction of nitrogen radicals into compounds of fatty series, 172
L., incomplete combustions, 174
Michael, A., and A. Adair, aromatic sulphones, 162
L. M. Norton, action of chloride of iodine upon aromatic amines, 162
Michler, M., and A. Gradmann, dimethyl-aniline, 173
Microphone, physical action of the, 246
Microscope, application of to special branches of chemistry, 150
Milk, albumen in and in serum, 22
solids in, 221
sugar, lactic fermentation of, 123
Millar, W. J., transmission of sounds by wires, 117
Miller, W. A., "Elements of Chemistry" (review), 226
Mills, E. J., and D. Wilson, action of oxides on salts, 246
Millstones, filling for, 123
Mineral acids in various commercial products, detection and estimation of free, 211, 237
growth, 152
new, 228
waters of Challes in Savoy, 142
"Mineralogical Magazine" (review), 249
"Mineralogy" (review), 160
Minerals for chemical analysis, separation of, 108, 152, 160
organic acids in the examination of, 14, 24, 65, 86, 98, 148
"Mines, Arts, and Manufactures, Dictionary of" (review), 259
Moissan, H., two allotropic varieties of magnetic oxide of iron, 142
Moll, J. W., origin of the carbon of plants, 153
Molybdenite of Biellese, 51
Monnet, P., and F. Reverdin, preparation of alcoholic chlorides, 21
Monobasic organic acids and amidines of the thiamides, 262
Monochlorhydrin of glycerin, isomer of the, 238
Mono-nitro-pyro-catechin, 228
Morley, H. F., Grove's gas-battery, 79
Morin, H., vitreous melted saccharose, 237
Morrison, R. M., electrolysis, 100
Morton, H., and W. E. Geyer, paraffins in commercial water gas, 187
Mouchot, M., industrial application of solar heat in Algeria, 227
Mühlhauser, O., and C. Hell, dibromide of acetic acid, 173
Muir, M. M. P., and S. Siguira, essential oil of sage, 211
certain bismuth compounds, 130
Muirhead, B. A., safety matches, 104
Mulberry-juice, citric acid as a constituent of imperfectly ripe, 6
Müller, A., action of potassium nitrite on nitranilide and acetonitranilide, 113
H. W., and W. De la Rue, electric discharge in tubes containing rarefied gases, 237
Muntz, A., and T. Schlœsing, nitrification by organised ferments, 52
Muntz, A., nitrification by organic ferments, 203
researches on the intra-cellular alcoholic fermentation of vegetables, 74
and M. de la Loyère, production of sulphuretted oils possessing insecticide properties, 262
Muter, J., Institute of Chemistry, 20
"Key to Organic Materia Medica" (review), 249
presentation to, 113
Mutschler, L., and F. König, estimation of free oxygen in well-water, 7
Myopism and civilisation, 32

NAPHTHALENE series, history of, 270
Nature's hygiene, 19
Naumann, A., distillation of aromatic bodies with aqueous vapour, 7
Neitzki, R., methyl-quinizarin, 7
nitranilic acid, 174
nitro-derivatives of the hydroquinons, 275
Newcastle-upon-Tyne Chemical Society, 167, 192, 207
"New Jersey Water Supply" (review), 248
Newlands, J. A. R., relations among the atomic weights of the elements, 255
New South Wales, Royal Society of, 28
Nickel, carburation of by the cementation process, 122
metallurgy of, 94
Nicol prisms in polarising apparatus principal section, 153
Nicotin, 174
Nilson, L. F., and O. Pettersson, physical properties and specific heat of glucinium, 195
specific heat of beryllium, 224
plato-nitrites and diplato-nitrites, 31
Niobium, metallic, and a new niobium chloride, 25
Nitranilic acid, 174
Nitranilide and aceto-nitranilide, action of potassium nitrite on, 113
Nitre losses in vitriol manufacture, 147, 195, 216
patent for supplying sulphuric acid chambers with, 203
Nitric acid, carbolic test for, 3
solution of molybdate of ammonia in, 98
and nitrous acids, determination of, 274
Nitrification by organic ferments, 203
ferment, theory of, 268
Nitriles into amides, transformation of, 161
Nitrobutan, normal, 173
Nitro compounds, action of on sulphuretted nitrogen, 6
reduction of with stannous chloride, 161
derivatives of the hydroquinons, 275
Nitro-mono-pyro-catechin, 228
Nitrogen and hydrogen, liquefaction of, 3, 11
as ammonia, action upon crops, 204
compounds, estimation of in oil of vitriol, 45
in nitro-glycerin of dynamite, 6
radicals, introduction of into compounds of fatty series, 172
Nitrogenous constituents of feeding beets, 133
Nitro-glycerin of dynamite, determination of nitrogen in, 6
Nitrosamines, aromatic, 129
Nitroso-furfurin and oxy-nitroso-furfurin, 263
Nitrous and nitric acids, determination of, 274
oxide, salts of, 270
Noelting and Boasson, MM., aromatic amines, 204
Non-ferruginous components of rocks, separation of, 121
Norton, L. M., and A. Michael, action of chloride of iodine upon aromatic amines, 162

ŒNOLIN, preparation of, 113
Oil of sage, essential, 211
Opium, action of perchloride of iron and concentrated sulphuric acid on some of the bases in, 158
bases, reaction with Lindo's test, 244
Opificius, M., extraction of platinum metals as practised in German refineries, 112
Optical rotatory power of liquids and dissolved substances, 263
Ores of copper, origin of some, 215
"Organic Materia Medica, Key to" (review), 249
Organic acids in the examination of minerals, 14, 24, 65, 86, 98, 148
certain, solubility of in alcohol and ether, 249
bodies considered in a gaseous state, refraction of, 262
ferments, nitrification by, 203
germs, room free from, 14
Otto, R., and H. Beckurts, dichloro-propionic acid, 7
formation of dichlor-propionic acid from pyruvic acid, 238
Oxalate, formation of crystals of calcium in urine, 76
Oxalic acid, action of sunlight upon solutions of, 9, 19
dried, action of on the primary, secondary, and tertiary alcohols, 227
Oxidation of aluminium, 228
Oxide, polymerisation of ethylen, 262
salts of nitrous, 270
coating iron with metallic, 220
Oxides, action of on salts, 246
Oxyanthraquinon carbonic acid, 162
Oxygen, action of on acid chlorides and analogous compounds, 195, 203
the anatomic elements, 123
and carbonic oxide, condensation of, 40
sulphur, direct fixation of upon benzin and toluen, 203
the halogens, relative affinities and reciprocal displacements of combined with metals, 152
density of liquid, 74
disengagement of from green twigs submerged in water previously boiled and exposed to the sun, 251
in Bessemer steel, 48
metallic silver, 81
the fatty series, substitution of sulphur for, 153, 250
well-water, estimation of free, 7
liquefaction of, 1, 40, 41
separation of media free from, 31
Oxygenated haloids compounds of the fatty series, action of ethyl-chlor-carbonate, 271
water, formation of during electrolysis, 82
Ozone, action of upon iodine, 183
detection of in the air, 262
formation of during electrolysis, 82
stability of, 83

PAGLIANI, S., action of anhydrous sulphurous acid upon alcohols, 264
formation of the corresponding alcohols in the preparation of aldehyds as on Piria's method, 205
Palladium, new compound of, 261
wire for the determination of hydrocarbides mixed with air in small proportions, 10
Paraffins, eudiometric analysis of mixtures of, 226
in commercial water-gas, 187
Paterno, E., and P. Spica, betulin, 51
experiment on betulin, 3
Patterson, Mr., and Dr. Wright, citric acid as a constituent of imperfectly ripe muloerry juice, 6
Paul, B. H., "Industrial Chemistry" (review), 234
and C. T. Kingzett, notes on tannin, 68
Pelletierin, 274
Pellet, H., distribution of salts in the soil, 262
new carbonated cupric liquid for the determination of glucose, 142
solubility of magnesia, baryta, and sulphate of lime in solutions of sugar, 134
Penin, A., and F. Klein, transformation of nitriles into amides, 161
Pentoxide, sulphates of vanadium, 162
Perkin, W. H., action of ammonia on anthrapurpurin, 110
new derivatives of anisol, 109
Permanganates, action of reducing agents on potassium, 36
Persulphuric acid, 73, 162
formation of during electrolysis, 82
Pettengill, J., Institute of Chemistry, 30
Pettenkofer and Decaisne, MM., telluric theory of cholera, 31
Petterson, O., and L. F. Nilson, physical properties and specific heat of glucinum, 195
specific heat of beryllium, 224
Pfaundler, L., smallest absolute number of vibrations necessary to yield a tone, 28
"Pharmaceutical Association, Proceedings of the American" (review), 119
Pharmacy, South London School of, 163
"Pharmacy, Year-Book of" (review), 119
Phenol, volumetric analysis of, 203
Phenyl-hydantoin, 7
Philipp, J., constitution of ultramarine, 265
green and blue ultramarine, 174
Phillips, S. E., study of platammonia compounds, 209, 231
Phipson, T. L., melilotal, 196
production of heat by chemical action, 262
urea and crenate of ammonia in spring-waters, 233
Phlorose, 263
Phosphates, studies on, 63
Phosphorus, estimation of in iron and steel, 68, 80
Photo-chemical combinations waves of ether in, 142
"Photography, Treatise on" (review), 159
Photometer, new spectro, 31
Phthalic acid, synthesis of, 220
Physical and Chemical Society, University College, 118
Physical Society, 37, 59, 79, 99, 117, 140, 158, 202, 212, 246, 271
Physiology, chemical, aspects of vegetable, 190
Phytosterin and cholesterin, 263
Pictet, R., density of liquid oxygen, 74
liquefaction of hydrogen, 83
of oxygen, 1, 41
Pickering, S., action of sulphuric acid on copper, 36
Pillitz, W., absorptive power of soils, 251
Pimarate, products of the dry distillation of calcium, 274

Pinus Sylvestris, hydrocarbons obtained from, 5
Planté, G., effects of the rheostatic machine, 184
engraving on glass by means of electricity, 51
Plants, chemical composition and functions of the leaves of, 142
influence of surface of leaves on the evaporation of, 133
origin of the carbon of, 153
Plat-ammonia compounds, study of, 209, 231
Plateau, production of the laminary systems of, 237
Platinum metals, extraction of as in German refineries, 112
solution of in sulphuric acid, 237
Plato-nitrites and diplato-nitrites, 31
Plimpton, R. T., preparation of glycollic acid, 110
Plicque, J. F., reply to E. Guimet, 94
Pneumatic battery, 140
Pokorny, Fielder, and Co.'s laboratory, work done in, 199
Polarising apparatus, principal section of Nicol prisms in, 153
Polariscope, new form of, 271
Polarised light, effect of starch, salicene, &c., on, 271
Pollacci, E., reagent for reducing glucose, &c., 263
"Pollen" (review), 50
Polyatomic alcohols, reaction peculiar to certain, 133, 196
Polygonum tinctorium, indigo-blue from, 223
Polyiodides, 110
Polymerisation of ethylen oxide, 262
Polytechnic, Royal, 175
Potash, nitrate of, iodine, and bromine, manufacture of, 56
Potassa, alcoholic, 203
and soda, direct manufacture of from their chlorides, 52
volumetric method of determining, 122
Potassium cyanide and alcoholic potassa, behaviour of tetrachlor-ether and acetyl-chloral alcoholate with, 274
nitrite, action of upon nitranilide and aceto-nitranilide, 113
permanganate, action of reducing agents on, 36
light reflected by, 247
xanthogenate for the quantitative determination of carbon bisulphide, &c., in presence of alkaline carbonates, 63
Prague University laboratory, 262
Precipitates, new method for the separation of, 181
weighing, 109, 116, 158, 160
Preece, W. H., Byrne's pneumatic battery, 140
physical points connected with the telephone, 37
Prescott, A. B., formation of crystals of calcium oxalate in urine, 76
tests of the service of a domestic water-filter, 107
Proctor, H. R., estimation of tannins, 256
the Chemical Society, 141
Propyl-glycol, new method of preparing, 238
Prudhomme, M., synthesis of indol, 21
Pseudo-cumenol, and constitution of pseudo-cumenol-sulphonic acid, durol, &c., 161
derivatives of, 161
Puls, J., albumen in serum and in milk, 22
Purgotti, E., guaiacum resin condered as a reagent of salts of copper, 264
Pyrogenous derivative of tartaric acid, 147, 250
Pyrites, copper, copper from by the aid of two waste-products, 65
Pyrotritaric and carbo-pyrotritaric acids, 270
Pyruvic acid, formation of dichlor-propionic acid from, 238

QUANTITATIVE analyses, colour-comparator for, 229
Quartz, reproduction of by the dry way, 262
Quinine, decomposition products of, 37

RADIATION, repulsion resulting from, 102
absorption of through bodies, and its application in quantitative analysis, 10
Radiations, absorptions of across bodies, 46
transparence of coloured flames for their own, 237
Radiometer, remarks on the, 251
Radloff, J., derivatives of pseudo-cumol-sulphonic acid, 161
Ramsay, W., and J. Dobbie, decomposition - products of quinine, 37
Rays, absorption of ultra-violet by various substances, 184
Readwin, T. A., mineral growth, 152
spontaneous metal growth, 172
Refraction, double, researches on accideotal, 103
Rehoux, M., origin of natural amber distinguished from artificial amber, 31
Reincke, F., and O. Wallach, tribromo-lactic acid, &c., 174
Renouard, A., manurial experiments upon flax, 204
Repulsion resulting from radiation, 102
Resonators, brass wind instruments as, 222
Reuter, A,. pseudo-cumenol, and constitution of pseudo-cumol-sulphonic acid, durol, &c., 161
Reverdin, F., and P. Monnet, preparation of alcoholic chlorides, 21
Reynier, E., new electric incandescent lamp, 262
Reynolds, J. E., measuring apparatus for laboratory spectroscope, 115
rapid estimation of urea, 135
Rheostatic machine, effects of, 184
Ricket, C., acid of the gastric juice, 153
lactic fermentation of milk-sugar, 123
Riecke, M., remarks on the radiometer, 251
Riley, E., analyses of steel, 226
estimation of phosphorus in iron and steel, 68
Rivers, extraordinary pollution of, 22
Rocks, separation of the non-ferruginous components of, 121
Rœmer, H., and E. Schunck, notes on madder colouring matters, 271
Room free from organic germs, 14
Roscoe, H. E., metallic niobium and a new niobium chloride, 25
Rose, Bengale, 196
Rosolic acid, 52
Ross, H., writing fluid, 251
Russian scientific news, 22, 123, 154, 185, 205, 221, 265
Royal Institution of Great Britain, 59, 101
Royal Society, 154
of New South Wales, 28

SACCHAROSE, vitreous, melted, 237
Sachs, T., curarin, 175
Safety matches, 114
Sage, essential oil of, 211
St. Pierre, C., and L. Magniers, researches on the maturation of grapes, 122
Salet, G., telephony, 121
Salford and Manchester Sanitary Association, 276
Salicene, starch, &c., effect of on polarised light, 271
Saline impurities, retention of by hydrated ferric oxide, 26
Salkowski, E., allantoin and hippuric acid in the urine of dogs, 275
Salter, T. W., thallium pigments, 96
Salts, action of on oxides, 246
Santa Caterina, constitution and structure of meteoric iron of, 61
Sauer, A., and E. Ador, determination of nitrogen in the nitro-glycerin of dynamite, 6
Savoy, mineral waters of Challes, 142
Scheurer, O., new discharge for vat-blues, 250
Schiff, R., decompositions of strychnine, 263
nitroso-furfurin and oxynitroso-furfurin, 263
and G. Tassinari, ammoniacal derivatives of chloral, 51
Schizomycetenic fermentations, 161
Schlœsing, T., and A. Muntz, nitrification by organised ferments, 52, 203
Schmidt, T., manufacture of iodine, bromine, and nitrate of potash, 56
Schœne, E., atmospheric hydrogen peroxide, 275
Schorlemmer, C., and R. S. Dale, on aurin, 213
Schultz, A., E. Mach, and F. Kurmann, ripening process of grapes, 251
G., benz-erythren, 162
Schulze, E., and A. Urich, nitrogenous constituents of feeding beets, 133
Schunck, E., indigo-blue from Polygonum tinctorium and other plants, 223
and H. Rœmer, notes on madder colouring matters, 271
Schützenberger, P., allotropic modification of copper, 274
combustion of gases, 142
constitution of wool and certain similar products, 184
Schrœbel, P., phenyl-hydantoin, 7
Scichilone, S., dilatation of fused sulphur, 51
Science, American Association for the Advancement of, 265
"Science for All" (review), 160
Scotch soda, falsification of, 123
Sea-water, candles altered by long exposure to, 165
Secher, E., specific heat of mixtures of methyl-alcohol and water, 28
Sedlon, M., use of chlorhydrin in tanneries, 22
Selenide, sulphide, and telluride of silver in a crystalline state, and of filiform silver, 20
Selmi, F., cadaveric alkaloids, importance in Toxicology, 264
Senier, A., and A. J. G. Lowe, test for glycerin, 246
Serum and milk, albumen in, 22
Sewage farming at Gennevilliers, 276
treatment, 52
Sibson, A., "Artificial Manures" (review), 171
Siguira, S., and M. M. P. Muir, essential oil of sage, 211
Silica, crystallisation of in the dry way, 237
Silicates, analysis of by lead oxide, 112
separation of crystalline silicic acid when mixed with, 162
Silver, filiform, and sulphide, selenide, and telluride of in a crystalline state 20
Silver, metallic, oxygen in, 81
Slater, H. H., ammonia in filtered water, 19
Smith, F., and F. Frerichs, didymium and lanthanum, 250
"Smithsonian Institution Annual Report" (review), 49
Smolensky, P., proportion of carbonic acid in the ground air, 204
Soap, adulteration of, 205
Soda and potassa, direct manufacture of from their chlorides, 52
Sodium, action of on chinoline and lepidine, 85
Soil, absorption of bases by the 204
and forests, influence of upon climate, 10
distribution of salts in, 262
Soils, absorptive power of, 251
analysis of, 204
beet-root sickness in, 204
Sokol Banja, in Servia, meteor in, 162
Solar heat, industrial application of in Algeria, 227
spectrum, certain consequences of the constitution of the, 123
dark rays of, and the constitution of the sun, 102
ultra violet, 83
Solids in milk, 221
Solvay, E., and R. Lucion, action of stable anhydrous acids on stable anhydrous bases, 21
Sonorous vibrations, action of, 197
Sonstadt's solution, application of to the separation of minerals for chemical analysis, 120, 152, 160
Sonstadt, E., work done in Messrs. Pokorny, Fielder, and Co.'s laboratory, 199
Sorby, H. C., application of the microscope to some special branches of chemistry, 150
Soret, J. L., absorption of the violet rays by various substances, 184
ultra violet, absorption spectra of the earths in gadolinite, 237
Sounds by wires, transmission of, 117
South London School of Pharmacy, 163
Space, co-ordination of, 272
"Spectra, Photographed" (review), 118
Spectral analysis, absorption of radiation through bodies, and its application to quantitative, 10
quantitative analysis, 31
Spectro-photometer, new, 31
"Spectroscope, How to Work with the" (review), 226
laboratory, measuring apparatus for, 115
new direct-vision, 103
Spectrum, solar, certain consequences of the constitution of the, 123
ultra violet, 83
Spence, P., and A. Esilman, detection and estimation of free mineral acids in various commercial products, 211, 237
Spica, P., and E. Paterno, betulin, 51
experiment on betulin, 3
Spitzer, F. V., new chloride of camphor, 238
Spring waters, urea and crenate of ammonia in, 233
Standage, H. E., safety matches, 114
Stannous chloride, reduction of nitro-compounds with, 161
Starch, salicene, &c., effect of on polarised light, 271
works, use of waste waters of 133
Ste.-Claire Deville, H., and H. Debray, new compound of palladium, 216

St. Petersburg, laboratory at, 263
Steel, analyses of, 226
and iron, estimation of phosphorus in, 80
Bessemer, specific gravity of, 199
oxygen in, 48
plates from Bessemer ingots, preparation of, 220
"Steel and Iron Industries, Report of Foreign" (review), 261
Stenhouse J., and C. E. Groves, history of the naphthalene series, 270
Stierlin, R., "Beer Adulterations" (review), 171
Stop-cock flask, 20
Storer, F. H., ferment theory of nitrification, 268
String telephone and telephone of Bell, 121
Strontium, barium, and calcium, volatility of, 63
Strychnine, decompositions of, 263
Sugar analysis, 37
ash, analyses of cane and beet-root, 127
analysis of cane, 76
beets, cultivation of, 133
candy, manufacture of, 30
tests, 273
Suguira, S., and C. F. Cross, action of the halogens at high temperatures on metallic oxides, 270
decomposition of ultramarine by carbonic acid, 213
Sulphur and oxygen, direct fixation upon benzin and toluen, 203
Sulphides in presence of boiling water, dissociation of, 250
Sulphin compounds of thio-urea, 275
Sulphites and hyposulphites, estimation of, 224
Sulphones, aromatic, 162
Sulphur, action of bromine upon, 212
certain artificial colouring matters fixed by, 250
chloride of, 153
dilatation of fused, 51
substitution of for oxygen in the fatty series, 153, 250
Sulphuretted nitrogen, action of on nitro-compounds, 6
oils, production of possessing insecticide properties, 262
Sulphuric acid, action of on copper, 36
concentrated, and perchloride of iron, action of on some of the bases in opium, 158
disinfecting properties of cellulosic substances carbonised with concentrated, 32
formation of fructose from sucrose and, 133
substances formed from hydro- and isohydro-benzoin from the action of dilute, 162
Sulphurous acid, anhydrous action of on alcohols, 264
injury done to forests by, 204
Sun, constitution of the, and dark rays of the solar spectrum, 102
Sunlight, action of upon solutions of oxalic acid, 9, 19
discolouration of green leaves in intense, 133
Swindells, J. H., filling for millstones, 123
falsification of Scotch soda, 123
prevention of hydrophobia, 94

TANNERIES, use of chlorhydrin in, 22
Tannin, extracts of, 265
Tannins, 68
estimation of, 256
Tartars, determination of natural tartrate of lime in crude, 227
Tassinari, G., and R. Schiff, ammoniacal derivatives of chloral, 51
Tauret, C., and M. Villiers, identity of muscular inosite and the vegetable sugars of the same composition, 122
ergotinin, 203
hydrate of ether, 184
pelletierin, 274
Telegraphic use of the telephone, 237
Telephone battery, 122
modifications of, 74
on board the "Desaix," 274
physical points connected with the, 37
relaying of the, 255
suppression of return wire, 237
telegraphic use of, 237
the, 22, 262
theory of, 142
writing, 62
Telluric theory of cholera, 31
Telluride, sulphide, and selenide of silver in a crystalline state, and of filiform silver, 20
Terpenes and camphor, constitu- of, 45
Terpin and terpinol, 166
Terquem, A., production of the laminary systems of Plateau, 237
Tetra-chlor-ether and acetyl-chloral alcoholate, behaviour of with potassium cyanide and alcoholic potassa, 274
Tetrachloride, manganese, 270
Tetroxide, vanadium, sulphates of, 11
Thallic cyanide, thallous, 162
Thallium pigments, 96
Thallous cyanide, double salts of, 162
Thermic formation of isomeric bodies, 21
Thermo-electric currents in wires subjected to strain, 118
Thiamides, amidines and monobasic orgauic acids of the, 262
substituted, 174
Thio-urea, sulphin compounds of, 275
Thollon, M., new direct-vision spectroscope, 103
Thomas, J. W., action of hydrochloric acid upon chemical compounds, 246
cuprous chloride, &c., 6
Thompson, L., new products from coal-gas, 95
S. P., lantern slide galvanometer, 79
Thomson, E., and E. J. Houston, relaying of the telephone, 255
W., construction of a room free from organic germs, 14
influence of stress on magnetisation, 212
Thorne, L. T., and E. Frankland, luminosity of benzol when burnt with non-combustible gases, 36, 72
Thoulet, M., separation of the non-ferruginous components of rocks, 121
Tibirica, F., and V. Mery, formic acid, 174
Tidy, C. M., composition and quality of the Metropolitan water, 53, 63, 154, 202, 236
"London Water Supply" (review), 100
Tilden, W. A., determination of vapour densities, 219
hydrocarbons obtained from Pinus sylvestris, 15
terpin and terpinol, 166
Tin crystals, analysis of, 244
Tisley, S. C., harmonograph, 79
Tokio University, Japan, 265
Toluen and benzin, direct fixation of oxygen and sulphur on, 203
Tomlinson, C., motions of camphor, &c., 81
on the surface of water, 72
Tone, smallest absolute number of vibrations necessary to yield a, 28
Toning-baths, old, new method for precipitating gold in, 249
Towers, absorbing and denitrating, vitriol from, 125
Toxicology, importance of cadaveric alkaloids, 264
Trachsel, F., aroma of butter, 50
Traube, M., chemical theory of fermentation, 6
Treharne, J., cooling of fats, 131
Trève, M., application of the telephone on board the "Desaix," 274
Tribe, A., and Gladstone, J. H., action of the copper-zinc couple on alkaline oxy salts, 68
analogues between the action of the copper-zinc couple and occluded and nascent hydrogen, 245
Tribromo-lactic acid, &c., 174
Trichloride, iodine, action of upon carbon bisulphide, 224
Tri-iodide ammonium, 246
Trimethyl-sulphine, 130
Troost, L., densities of vapours, 103
observations relating to a paper upon chloral hydrate, 227
Truchot, M., fertility of volcanic soils, 83
Tschaporvitz, F., influence of the surface of leaves on the evaporation of plants, 133
Turpin, E., lakes of eosin and fluorescein for preparing decorative paintings without poison, 2
Tunbridge, G., safety matches, 114
Tweedie, G. K., coating iron with metallic oxide, 220

ULTRAMARINE, constitution of, 265
artificial, remarks on M. Plicquet's note on, 52
decomposition by carbonic acid, 213
green and blue, 174
Ultramarines, 113
Ultra-violet gadolinite, absorption spectra of the earths in, 237
rays, absorption of by various substances, 184
solar spectrum, 83
University College Chemical Society, 7
Dublin Experimental Science Association, 216
Edinburgh Chemical Society, 130, 216
of Durham, 32
of Freiburg, communications from the laboratory of the, 174
of Prague, laboratory of, 262
of Würzburg, communications from the laboratory of the, 93, 263
Tokio, Japan, 265
Urea and acetate of ammonia in spring waters, 233
Urine, formation of crystals of calcium oxalate in, 76
Urea, oxamide, and ammonium salts, action of alkaline hypobromite on, 270
rapid estimation of, 135
Urechites suberecta, poisonous principle of, 166
"Ure's Dictionary of Arts, Manufactures, and Mines" (review), 259
Urich, A., and E. Schulze, nitrogenous constituents of feeding beets, 133
Urine of dogs, allantoin and hippuric acid in, 275

VALENCY, relation between gaseous volume and, 194
Vanadium, separation of from iron and aluminium, 113
pentoxides, sulphates of, 127, 138, 162
tetroxide, sulphates of, 11
Vapours and gases, refraction of, 102
densities of, 103, 172, 219
Varenne, E., preparation of œnolin, 113
Vaucher, M., certain artificial colouring matters fixed by sulphur, 250
conversion of magenta into aniline-violet, 250
Vegetable and animal food, preserving, 221
physiology, chemical aspects of, 190
Villiers, A., acid acetates, 42
and Tauret, MM., indentity of muscular inosite and the vegetable sugars of the same composition, 122
Vincent, E., and M. Delachanal, nature of the highly volatile products contained in crude benzines, 104
Vinegar, acetic acid in, 173
Vine leaves, physiological function of, 3
Vines, S. H., chemical aspect of vegetable physiology, 190
Vitreous melted saccharose, 237
Vitriol, estimation of nitrogen compounds in, 45
from absorbing and denitrating towers, 125
manufacture, nitre losses in, 195, 216
nitric acid in the, 155, 194, 216
"Vision of Colours," extract from, 203
Volatile oils, connection of chemical compounds in, 275
products contained in crude benzines, nature of the highly, 104
Volcanic soils, fertility of, 83
Volhard, J., ammonium sulphocyanide in volumetric analysis, 77
Volney, Dr., weighing precipitates, 160
Von Bibra, E., restoration of writing effaced by time, 250
seasoning new casks, 250
Von Miller, W., new indicator in alkalimetry, 275
Von Sommaruga, E., action of ammonia on isatin, 93
Von Tunzelmann, G. W., thermo-electric currents in wires subjected to strain, 118
Von Wagner, R., history of rosolic acid, 52
"Volumetric Analysis" (review), 226
Volumetric analysis of phenol, 203
estimation of cyanides, 129

WAECHTER, F., relations between the atomic weights of the elements, 161
Wallace, Dr., analysis of cane-sugar ash, 76
Wallach, O., action of hydrocyanic acid, 174
and F. Reincke, tribromo-lactic acid, &c., 174
Wanklyn, J. A., Institute of Chemistry, 18, 51, 80
Warington, R., estimation of phosphorus in iron and steel, 80
Wash-bottle, improved form of, 110
movable jet for, 23
Waste waters of starch works, use of, 133
"Water" (review), 225
Water, ammonia in filtered, 9, 19, 30, 38, 93, 111
anhydrous acids and, 21
at Buda Pest, examination of, 274
colouration of, 94
decomposition of by iron pyrites, 49
Water-filter, domestic, tests of the service of a, 107
Water-gas, paraffins in commercial 187

Water, motions of camphor on the surface of, 72
Metropolitan, quality and composition of, 53, 63, 154, 202, 236
previously boiled and exposed to the sun, disengagement of oxygen from green twigs submerged in, 251
solubility of lime in, 103
specific heat of mixtures of methyl-alcohol and, 28
"Water Supply, London" (review), 100
"Water Supply of New Jersey" (review), 248
Waters, mineral, of Challes in Savoy, 142
Watery vapour, action of on the hydrocarbides raised to a red heat, 262
Well-water, estimation of free oxygen in, 7
Weselsky, P., and R. Benedikt azophenols, 238
Whewell, G., fees, 61
Williams, C. G., action of sodium on chinoline and lepidine, 85
W. C., and T. Carnelly, determination of high boiling-points, 212
Willm, E., mineral waters of Challes in Savoy, 142
Wilson, D., and E. J. Mills, action of oxides on salts, 246
H., obtaining copper from copper pyrites with the aid of two waste products, 65
R., "Common Sense for Gas Users" (review), 235
Wines, analysis of, 94
Winogradow, W., action of brom-acetyl-bromide upon zinc-methyl and zinc-ethyl, 174
Wires subjected to strain, thermo-electric currents in, 118
transmission of sounds by, 117
Wischnegradsky, A., various amylens and amylic alcohols, 93
Witt, O. N., aromatic nitrosamines 129
Woodward, C. J., movable jet for wash-bottle, 23
Wool and certain similar products, constitution of, 184
carbonisation of vegetable matter among, 276
Wright, C. R. A., and A. P. Luff, alkaloids of the aconities, 67, 245
and Mr. Patterson, citric acid as a constituent of imperfectly ripe mulberry juice, 6
Writing effaced by time, restoration of, 250
Wurtz, A., polymerisation of ethylen oxide, 262
researches on law of Avogadro and of Ampère, 262

XANTHOGENATE, potassium for the quantitative determination of carbon bisulphide, &c., in presence of alkaline carbonates, 63

"YEAR-BOOK of Pharmacy' (review), 119
Yellow colouring matter, new, 56
Yolk of eggs, 154

ZEIDLER, O., compounds occurring in crude anthracen 250
Zincke, T., and A. Breuer, substances formed from hydro- and isohydro-benzoin by the action of dilute sulphuric acid, 162
Zinc-methyl and zinc-ethyl, action of brom-acetyl-bromide, 174
Zœller, R., and E. Grete, formation of ammonium nitrite, 74
Züblin, J., normal nitro-butan, 173
Zulkowsky, K., constituents of corallin, 238

WELLCOME LIBRARY INSTITUTE

END OF VOLUME XXXVII.